THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. XCIII. No. 2234.] LONDON, MARCH 6, 1906. [58TH YEAR. PRICE 6d.

PARKER & LESTER,

— *ESTABLISHED 1830.* —

MANUFACTURERS AND CONTRACTORS. **ORMSIDE STREET, LONDON, S.E.**

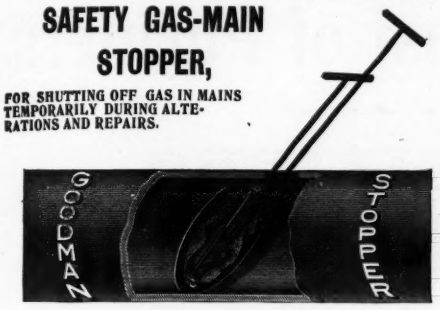
THE ONLY MAKERS OF

PATENT ANTIMONY PAINT & PARKER'S IMPERIAL BLACK VARNISH.

OXIDE PAINTS, OILS, AND GENERAL STORES, FOR GAS AND WATER WORKS.

SAFETY GAS-MAIN STOPPER,

FOR SHUTTING OFF GAS IN MAINS TEMPORARILY DURING ALTERATIONS AND REPAIRS.



SHORT'S PATENT

GAS-LEAK INDICATORS.

FOR GROUND USE. FLUSH BOXES ETC.

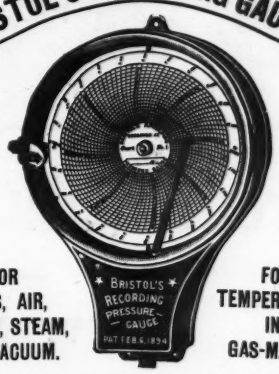
HIGHLY SENSITIVE. LONG-RANGE.

FOR PURIFIER BLOW-OFF VALVES.

FOR HARD USAGE.

WITH ALL LATEST IMPROVEMENTS.

BRISTOL'S RECORDING GAUGES



FOR GAS, AIR, WATER, STEAM, OR VACUUM.

FOR TEMPERATURE IN GAS-MAINS.

Many Thousands in Daily Operation.

J. W. & C. J. PHILLIPS,
23, COLLEGE HILL,
LONDON, E.C.

GAS COOKER REPLACEMENTS

ANY PATTERN MADE INTERCHANGEABLE WITH THE PART NOW IN USE.

Telegrams: "AMOUR, LONDON."
Telephone Nos.: 1890 HOLBORN; CENTRAL 194.

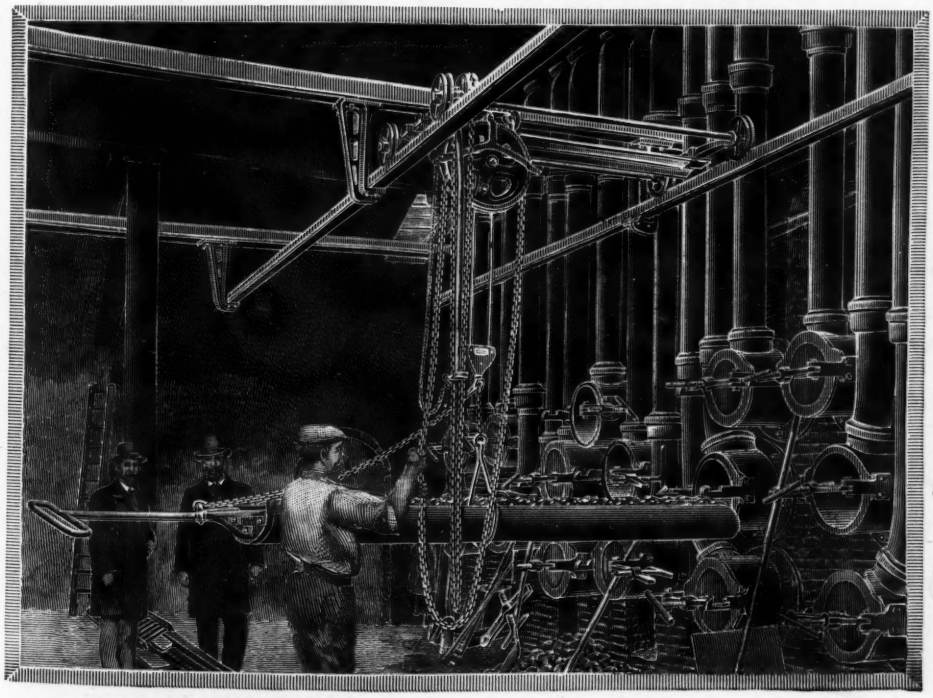
A. G. CLOAKE,
54, HOLBORN VIADUCT, LONDON, E.C.

BIGGS, WALL, & CO.

13, CROSS STREET, FINSBURY, LONDON, E.C.

Works: **New Southgate.**

Telegrams: "RAGOUT, LONDON."
Telephone: 273 CENTRAL.



As worked by one Man at Harlow Gas-Works.

"RAPID" MANUAL CHARGING MACHINE.

Annual Yield per Retort increased many thousands of feet.

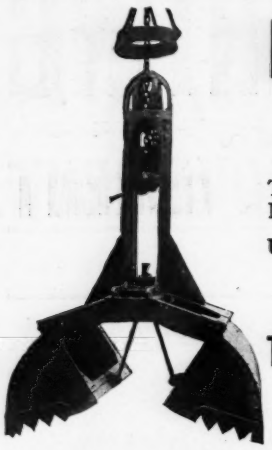
EVEN CHARGES.

Repeat Orders—

Yeovil, Newport, Worthing, Southbank, Aldershot, Trowbridge.

Machines can be seen working at any of the following Gas-Works:—

ALDERSHOT, HARLOW, WORTHING, NEWPORT (MON.), YEOVIL, GRAYS, NORMANTON, TRURO, WESTON-SUPER-MARE, GOOLE, ABERGAVENNY, &c., &c.



HONE'S PATENT GRABS

Automatic, Efficient, & Economical.

APPLICABLE TO ANY ORDINARY SINGLE CHAIN CRANE.

These Grabs are unequalled for handling Coal, Coke, Ballast, Sand, Macadam, Ores, &c. effecting in all cases very substantial savings.

Used by all the Principal Gas Companies, Colliery Owners, Coal Merchants, Engineers, Contractors, &c., at Home and Abroad.

Applications for Prices and Particulars are invited by the Sole Manufacturer—

THE THAMES IRON WORKS, SHIPBUILDING, and ENGINEERING COMPANY, LTD.,

CANNING TOWN, LONDON, E.

Great Reduction in the Cost of Purifiers

LUTELESS PURIFIERS

WORKED WITHOUT ANY CONNECTIONS AT ALL

(RAMSDEN & SMITH'S PATENT, No. 12,034.)

No complicated arrangement of Valves, each requiring separate manipulation.

No Internal Pipes interfering with Purifying Area.

Every part easily accessible.

FOR PRICES AND ALL PARTICULARS, APPLY TO THE MAKERS:

EDWARD COCKEY & SONS, LD.

Engineers and Contractors for Gas Plant of every Description,

FROME, SOMERSET.

Telegrams: "COCKEYS, FROME." — Telephone No. 16 FROME. — Telegrams: "DAMPER, LONDON."

London Office: BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C. Messrs. BALE & HARDY, Agents.

Every Description of

FIRE-CLAY GOODS

OF BEST QUALITY ONLY.

Personal attention given to all orders.

MOBBERLEY & PERRY, STOURBRIDGE.

INCLINED AND HORIZONTAL RETORTS of both Taper and Parallel Sections.

SPECIALS FOR WATER GAS PLANTS.

CHECKER BRICKS ALWAYS IN STOCK.

LARGE STOCKS KEPT.

THE BARROWFIELD IRON-WORKS, LTD.,

GAS ENGINEERS AND CONTRACTORS,

GLASGOW.

Telegrams:
"GASOMETER, GLASGOW."

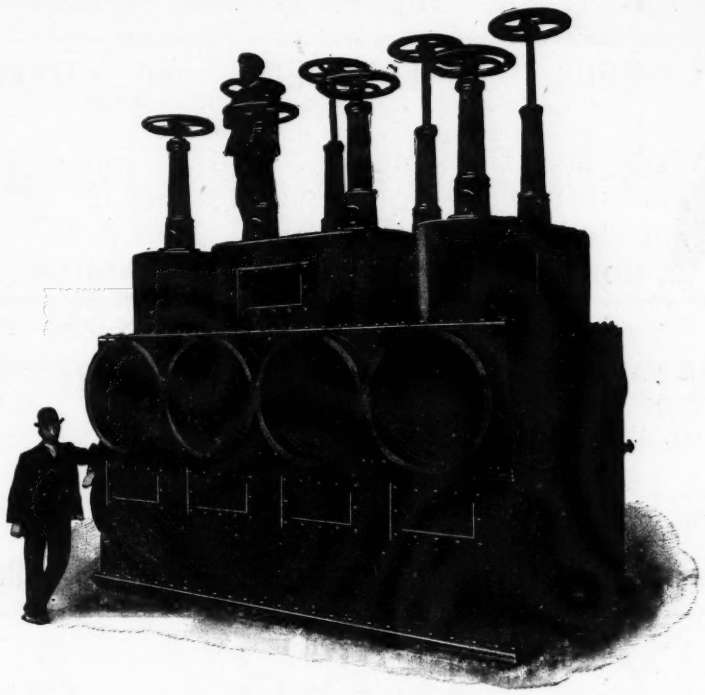
OIL PLANT AND CHEMICAL APPARATUS.

BRIDGES, GIRDERS, WHARVES, PIERS.

ROOFING OF EVERY STYLE.

PIPES, VALVES, AND CONNECTIONS.

London Office:
6, LITTLE BUSH LANE, CANNON STREET, E.C.



Weck's Centre-Valve for 30-inch Connections for GRANTON GAS-WORKS of the EDINBURGH and LEITH CORPORATIONS GAS COMMISSIONERS.

GAS APPARATUS OF EVERY DESCRIPTION.

RETORTS, CONDENSERS, SCRUBBERS, PURIFIERS.

GASHOLDERS AND TANKS.

ENGINES, EXHAUSTERS, STEAM-BOILERS, AND FITTINGS.

GEORGE ORME & CO. (Branch of Meters Ltd.)

ATLAS METER WORKS,

Tel. Address: "ORME OLDHAM."
Telephone No. 93 Oldham.

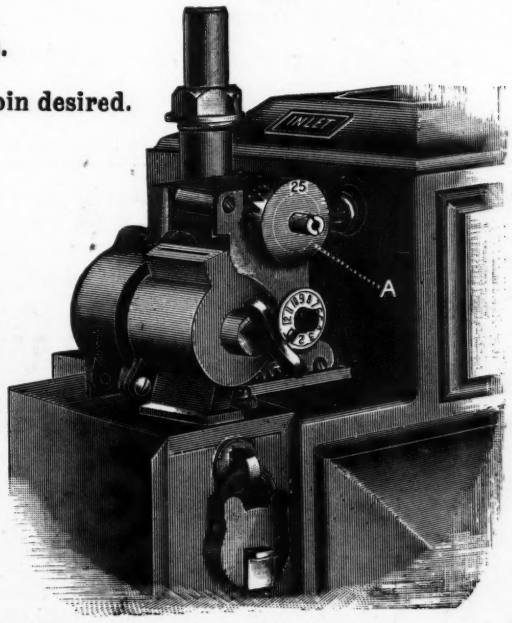
PARK STREET, OLDHAM.

"NEW CENTURY" PATTERN

Patent Coin Prepayment Gas-Meters

Fitted with Detachable Attachments.

Arranged for 1d., 1s., or any other Coin desired.



Change of Price effected by simply removing Crown Wheel "A" and replacing same with another Wheel.

ANY FURTHER PARTICULARS WILL BE SUPPLIED UPON APPLICATION.

NEWTON, CHAMBERS, & CO.,

LIMITED.

THORNCLIFFE IRON-WORKS, near SHEFFIELD.

Established 1790

LONDON OFFICE: **19, Great George Street, WESTMINSTER.**

Telegraphic Addresses, "NEWTON, SHEFFIELD," "ACCOLADE, LONDON."

GAS ENGINEERS, IRONFOUNDERS, and CONTRACTORS.

MANUFACTURERS OF EVERY DESCRIPTION OF

PLANT, APPARATUS, AND MACHINERY FOR GAS AND CHEMICAL WORKS.
RETORTS AND FITTINGS, MOUTHPIECES WITH SELF-SEALING LIDS.
IMPROVED COAL AND COKE HANDLING PLANT, CONVEYORS, AND ELEVATORS.
CONDENSERS, SCRUBBERS, AND WASHERS.

PURIFIERS with Planed Joints a Speciality.

PATENT CENTRE-VALVES, RACK AND SCREW VALVES, WOOD GRIDS AND SCRUBBER-BOARDS, CAST-IRON MAINS, AND SPECIALS.
STRUCTURAL WORK, COLUMNS, GIRDERS, AND ROOFING.
GASHOLDERS, CAST-IRON OR STEEL TANKS.

DESIGNS, SPECIFICATIONS, and ESTIMATES FREE.

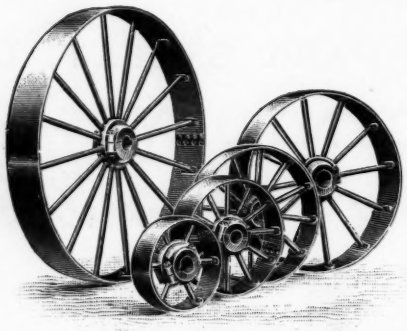
PIG IRON (SPECIAL QUALITY) for Engine Cylinders. GAS COAL famous for its Unrivalled excellence.

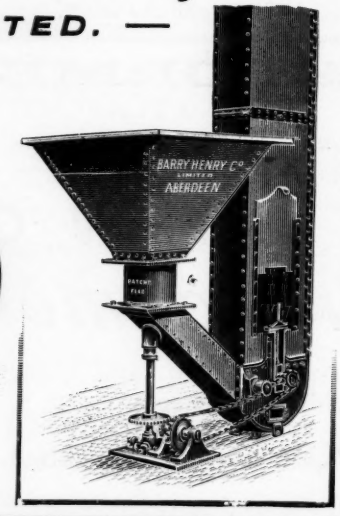
BARRY, HENRY, & CO.,

— *LIMITED.* —

Specialities:
TRANSMISSION OF POWER.
Rope & Belt Pulleys,
Spur & Bevel Wheels,
Shafting & Couplings,
Pedestals, & Fixings.

WORKS:
ABERDEEN,
SCOTLAND.





Specialities:
TRANSMISSION OF MATERIALS.
Conveyors,
Elevators,
Grinding Machinery,
Motors.

AND
64, MARK LANE,
LONDON, E.C.

GAS
THE WINSTANLEY SPECIALTY COY.
ENGINEERS

GAS ENGINEERS.

Contractors for, and Erectors of, all Gas-Works Plant.

REGENERATORS, GENERATORS, AND DIRECT-FIRED RETORTS.

RESULTS GUARANTEED.

Complete Installations of Horizontal and Inclined Retorts.

ADDRESS—
NEWTON CHAMBERS, CANNON STREET, **BIRMINGHAM.**

MODERN GAS APPARATUS.

C. & W. WALKER, LTD.

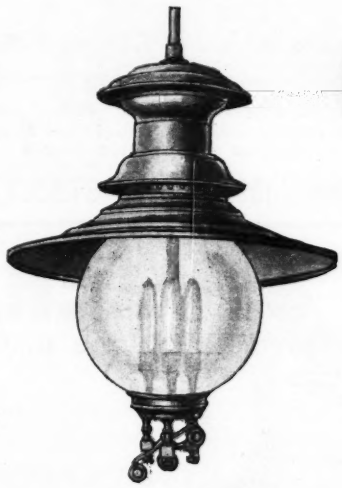
London Office:
110, CANNON STREET, E.C.

Midland Iron-Works:
DONNINGTON, near NEWPORT, SALOP.

TWO USEFUL ARTICLES.

The "Pilot" Patent.

Giving an intense light, as a reminder that Gas is not yet "done with."



£1 16s. 6d.

GUARANTEED BY

POND & CO.,

to be made entirely on the "Island," and equal to any other on sale (imported or otherwise).

Catalogue Free, showing the advantages of these Lamps and many others.

"Dwarf Wis" Patent.

Quite a new departure, suitable for low ceilings. Consuming its own smoke. 16 inches over all.

£1 5s. 0d.

Inventors, Patentees, Lighting Experts, and Manufacturers,

59, FARRINGDON STREET, and 24, FARRINGDON AVENUE, LONDON, E.C.

INSTALLATIONS AT THE GAS-WORKS OF—

West Bromwich, Ilford, Tipton, Bilston, Cleethorpes, Rushden and Higham Ferrers, Barking, Ilfracombe, Cape Town, Erfurt, Pfortsheim, Iserlohn, Barmen-Rittershausen, Mülheim a.d. Ruhr, Nürnberg, Plauen, Rome, Lyons, Gijon, Brummen, Osterfeld, Warstein, Wiborg.

HIGHEST EFFICIENCY.
GREATEST ECONOMY.

THE DELLWIK-FLEISCHER WATER GAS PROCESS.
PATENTS IN ALL COUNTRIES.
BLUE WATER GAS, CARBURETTED WATER GAS.

COMBINED WITH
SELF-CARBURETTING
AT
Imperial Continental Gas Association, Mariendorf-Berlin, Königsberg, Remscheid, Ludwigshafen, Güstrow, Salzwedel, Dortmund, Stuttgart, Hanau, Furth (Bavaria), Freiberg (Saxony), Osnabrück, Görlitz, Arnhem, Zutphen, Berne, St. Quentin, Barcelona, Beyrouth (Syria), Trieste.

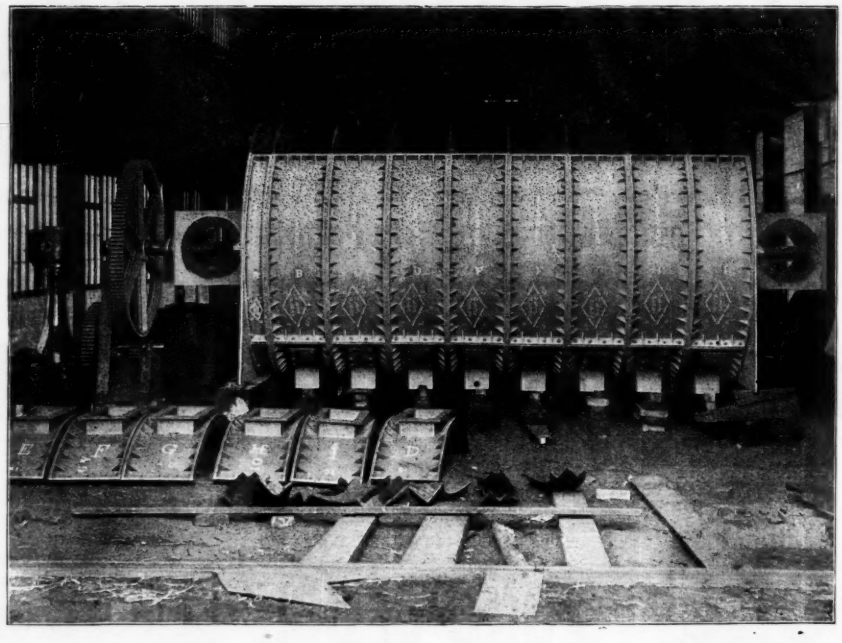
THE
DELLWIK-FLEISCHER WATER GAS SYNDICATE
72, VICTORIA STREET, WESTMINSTER, LONDON, S.W.

THE WHESSOE FOUNDRY CO., LTD.

Works: DARLINGTON.

LARGE AREA OF WASHING SURFACE.

REMOVAL OF THE WHOLE OF THE AMMONIA AND A LARGE PERCENTAGE OF CO_2 AND SH_2.



SLIP OF GAS IMPOSSIBLE OWING TO OUR PATENT TELESCOPIC SLIDING JOINT

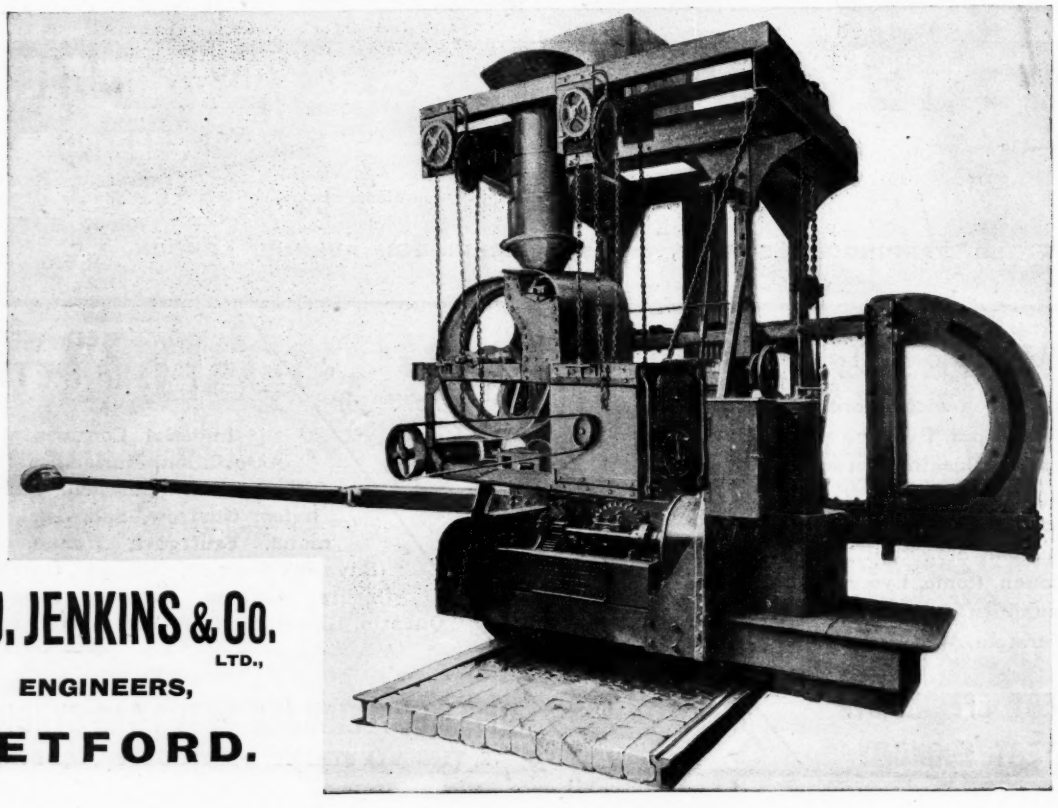
BUNDLES EASILY ACCESSIBLE FOR CLEANING.

"Whessoe" Rotary Washer-Scrubber (H. Kirkham & Chandler's patent). **Capacity 1,500,000 Cub. ft. per diem.**
One of Two Machines supplied by us to a Foreign Gas-Works, photographed in our shops during course of construction.

London Office: **106, CANNON STREET, E.C.**

THE COMPLETE STOKER.

Both Discharging and Charging Operations performed by one machine, for Retorts 20 feet through.



W. J. JENKINS & Co. LTD.,

ENGINEERS,

RETFORD.

GREAT REDUCTION IN PRICES

OF

"NICO"

Inverted Mantles from March 1st.

QUALITY UNIMPAIRED.

"NICO"

ARE THE BEST THAT CAN BE MADE.

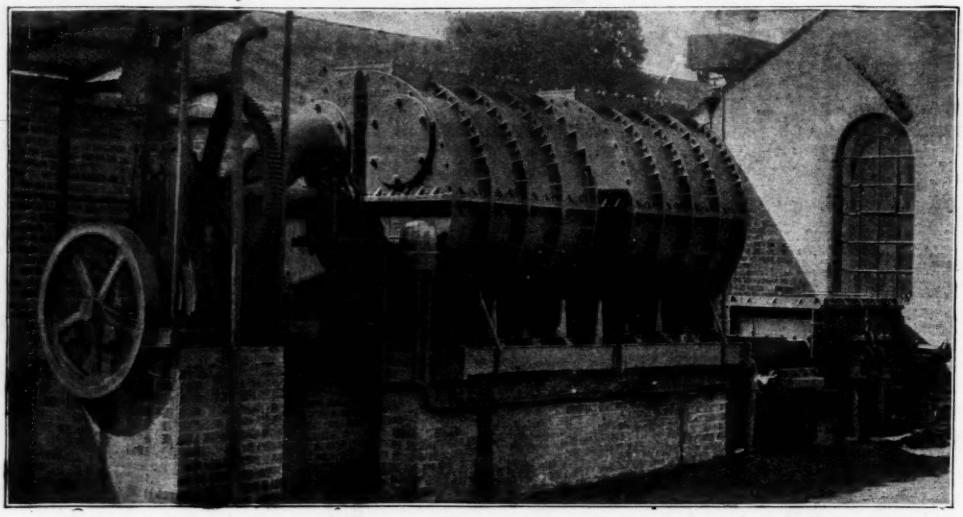
Unrivalled for

STRENGTH AND DURABILITY.

The New Inverted Incandescent Gas Lamp Co., Ltd.,

23, FARRINGDON AVENUE, LONDON, E.C.

KIRKHAM, HULETT, & CHANDLER, LIMITED.



No connection with any persons of similar Names or any Firm making use of such names.

Improved Patent "STANDARD" Washer-Scrubber and Tar-Washer.

ADDRESS:—**PALACE CHAMBERS, BRIDGE STREET, WESTMINSTER, S.W.**

Sole Agents for the Berlin-Anhaltische-Maschinenbau Act. Ges. Specialities.

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

MIDLAND AND WEST OF ENGLAND DISTRICT OFFICE: *6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.*
Telegraphic Address: "WIGAN, BIRMINGHAM." Telephone No. 200.

LONDON DISTRICT OFFICE: *6, STRAND, LONDON—C. PARKER & SON, Sole Agents.*
Telegraphic Address: "Parker, London."

DRAKES LTD. HALIFAX.

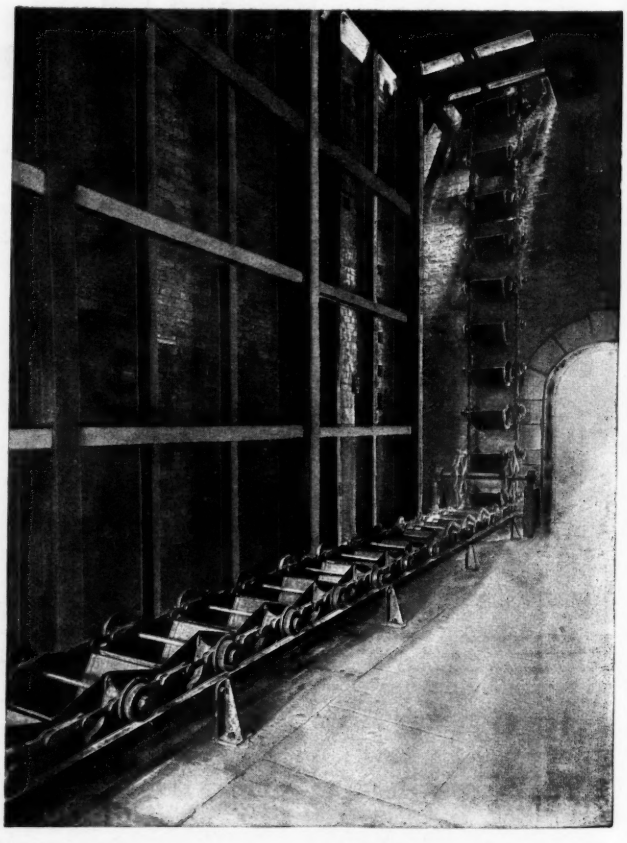
LONDON OFFICE:
181, QUEEN VICTORIA ST., E.C.

MELBOURNE:
31, QUEEN STREET.

Inclined Retort Installation,

WITH

Gravity Bucket Conveying Plant.



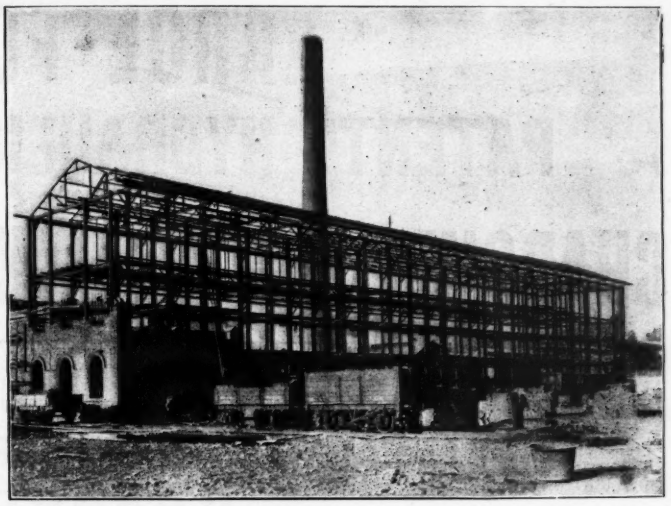
FOR

STEEL BUILDINGS

AND ALL OTHER

STRUCTURAL WORK

APPLY TO



Steel Frame Building, 246 ft. long, 40 ft. span, height, 80 ft.

Order placed August 23,
Erection started Sept. 18, } 1905.
Finished November 25,

ASHMORE, BENSON, PEASE, & CO., LTD.,

STOCKTON-ON-TEES.

TIMMIS'S PATENT

CLINKERING DOOR.

Illustrated Advertisement, with full Particulars, in "JOURNAL" for April 4, 1905, p. 66.

GEO. H. TIMMIS,

River Stour Works, STOURBRIDGE.

Telegrams: "TIMMIS, LYE." National Telephone: 13, LYE.

or of **HARPER & MOORES, LTD.,**

STOURBRIDGE.

ON THE ANALYSIS AND VALUATION

OF

OXIDE OF IRON AND LIME FOR PURPOSES OF GAS PURIFICATION,

WITH NOTES ON THE

Determination of Sulphuretted Hydrogen and Carbon Dioxide in Gas Liquor.

Amended and Enlarged from Articles published in the "Journal of Gas Lighting."

By H. LEICESTER GREVILLE, F.I.C., F.C.S.,

Member of the Society of Public Analysts, and of the Society of Chemical Industry. Late Chemist to the Commercial Gas Company, London.

Price 2s. 6d. Net.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E C.

TILLEY BROTHERS,

INVITE INQUIRIES FOR

SLOT INSTALLATIONS,

STREET LIGHTING,

PENDANTS, BRACKETS,

GLOBE-HOLDERS,

HARD-WOOD BLOCKS,

MAIN-COCKS, &c.

HEAD OFFICE:

53, KINGSLAND ROAD, LONDON, E.

EVERITT'S

PATENT TAR-EXTRACTOR

As a Naphthalene Remover.

The Exhaust Steam heats up the Tar and the Gas, and enables it to remove the maximum amount of Naphthalene. By removing the Tar, no Naphthalene is carried forward to the Scrubbers, except in strong and thorough combination with an **EXCESS** of light hydrocarbons, so evenly distributed and always sufficient in quantity to prevent the action of ammonia on the phenols liberating the Naphthalene dissolved by them.

SOLE MAKERS:

ROBERT DEMPSTER & SONS,

ROSE MOUNT IRON-WORKS, *LTD.*,

ELLAND, Yorks.

ARROL-FOULIS

PATENT HYDRAULIC MACHINERY

FOR

CHARGING AND DRAWING GAS-RETORTS

SIR WILLIAM ARROL & CO., Ltd., Sole Makers,
DALMARNOCK IRON-WORKS, BRIDGETON,
GLASGOW.

LONDON ADDRESS: 32, VICTORIA STREET, WESTMINSTER, S.W.

PLANS AND ESTIMATES FURNISHED ON APPLICATION.

THE
ARROL-FOULIS
MACHINES
Are Employed at the following Works—

GLASGOW GAS-WORKS—
Tradeston.
Dawsholm.
Dalmarnock.

GASLIGHT & COKE COMPANY—
Beckton.
Shoreditch.
Bromley.

SOUTH METROPOLITAN GAS COMPANY—
East Greenwich
Vauxhall.
Rotherhithe.

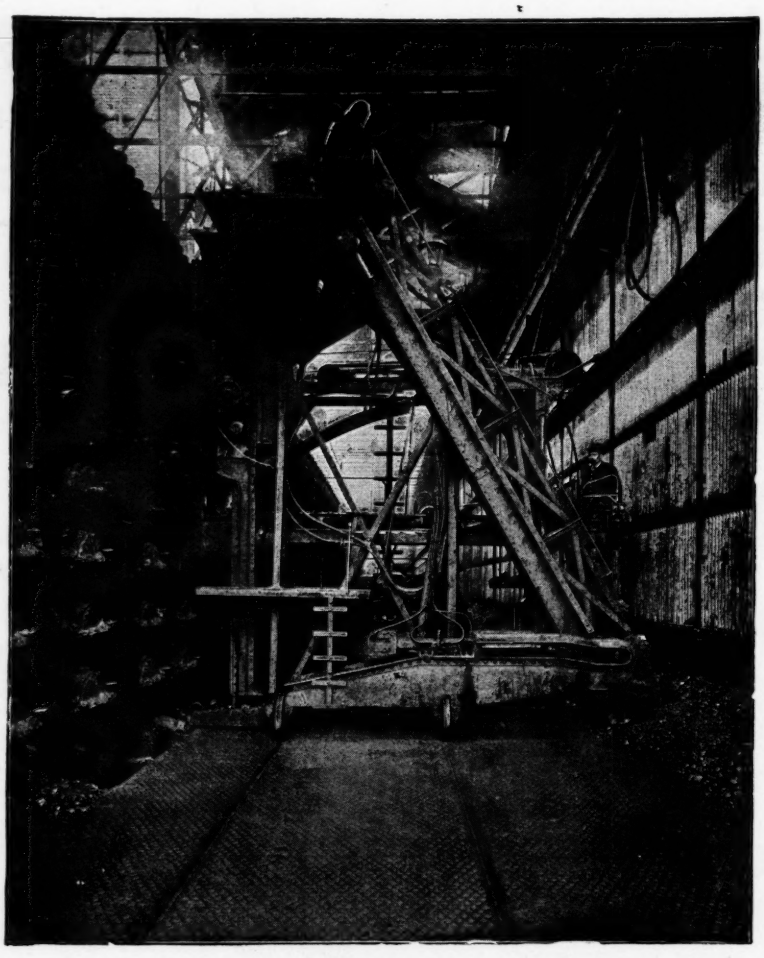
COMMERCIAL GAS-WORKS—
Wapping.
Poplar.

BROMLEY GAS-WORKS (KENT).

EDINBURGH GAS-WORKS.

LIVERPOOL GAS-WORKS.

BRIGHTON GAS-WORKS.



ROTHERHITHE GAS-WORKS.

THE
ARROL-FOULIS
MACHINES
Are Employed at the following Works—

LEEDS GAS-WORKS.

BIRMINGHAM GAS-WORKS.

BRITISH GAS CO.—
Hull.

BOLTON GAS-WORKS.

IMPERIAL CONTINENTAL GAS ASSOCIATION—
Amsterdam.
Vienna.
Berlin.

HAGUE CORPORATION GAS-WORKS—
Hague.

METROPOLITAN GAS-WORKS—
Melbourne.

CLEVELAND GAS-WORKS—
Cleveland, Ohio,
&c., &c., &c.

NEARLY
300 MACHINES
ARE AT
WORK OR IN COURSE OF CONSTRUCTION.

THE TIME TAKEN TO DRAW AND CHARGE EACH RETORT BY THESE MACHINES AVERAGES

UNDER ONE MINUTE.

WRIGHT'S

AUTOMATIC

High-Pressure Boiler.

The Boiler that does not **boil** Water,

because it isn't designed to do so.

The Boiler that does not waste Gas,

because it is designed not to do so.

The Boiler that does supply really Hot Water at any time, day or night,

because the Automatic Valve maintains the water at a fixed temperature.

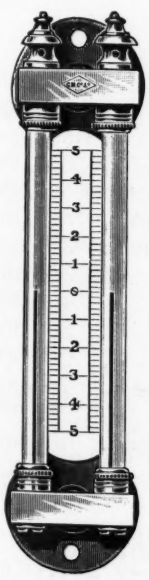
JOHN WRIGHT & CO., ESSEX WORKS, BIRMINGHAM.

THE GAS METER CO., LTD.,

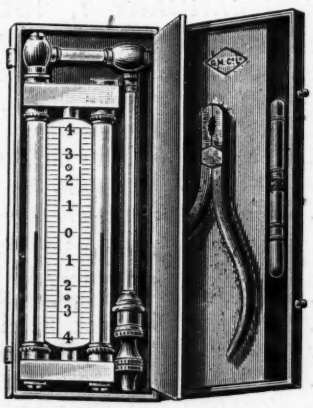
Manufacturers of

Wet & Dry Gas-Meters, Automatic Meters, Station Meters, Governors, Main Taps, Lamp Taps,

GAUGES, &c.



No. 1.

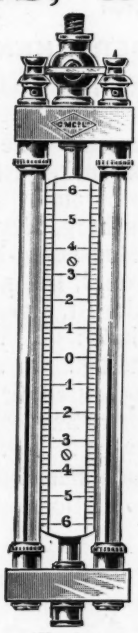


Inspector's Pocket Gauge.

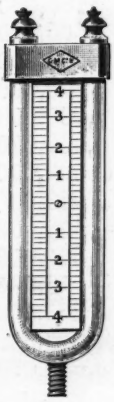
Telephone Nos:

142 Dalston (Nat.), 340 Oldham (Nat.), 1995 Dublin (Nat.), 2918 Manchester (Nat.).

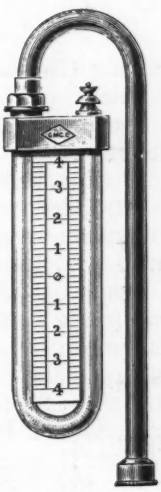
For Prices and Particulars apply:



No. 3.



No. 4.



No. 5.

Telegraphic Addresses:

"METER LONDON," "METER OLDHAM," "METER DUBLIN," "METER MANCHESTER."

Works: 238, Kingsland Road, LONDON; Union Street, OLDHAM; Hanover Street, DUBLIN; 18, Atkinson Street, Deansgate, MANCHESTER.

MESSRS. HUMPHREYS & GLASGOW

CARBURETTED-WATER-GAS PLANT

— DOUBLE-SUPERHEATER SYSTEM. —

	Cubic Feet Daily.		Cubic Feet Daily.		Cubic Feet Daily.
Aarhus, Denmark	800,000	G. L. & C. Co., Beckton	2,250,000	Redhill	275,000
Antwerp, Belgium	1,500,000	G. L. & C. Co., „ (2nd)	10,750,000	Redhill (Second)	300,000
Aylesbury	150,000	G. L. & C. Co., Bromley	3,750,000	Reichenberg, Bohemia	200,000
Barrow	300,000	G. L. & C. Co., Fulham	1,750,000	Romford	300,000
Bath	1,000,000	G. L. & C. Co., Nine Elms	2,750,000	Rotterdam, Holland	850,000
Belfast	1,700,000	Geneva, Switz.	500,000	Rotterdam, Holland (Second)	1,500,000
Belfast (Second)	4,500,000	Gosport	200,000	Rotterdam, Holland (Third)	750,000
Birmingham	1,500,000	Göteborg, Sweden	300,000	St. Gallen, Switz.	225,000
Bordentown, N.J.	125,000	Guildford	350,000	St. Joseph, Mo.	750,000
Bournemouth	1,000,000	Hamburg, Germany	1,750,000	Santiago de Cuba	400,000
Bremen, Germany	550,000	Hartlepool	750,000	Scarborough	800,000
Bremen, Germany (Second)	950,000	Hebden Bridge	200,000	Shanghai	225,000
Brentford	1,200,000	Heidelberg, Germany	200,000	Shanghai (Second)	225,000
Bridlington	150,000	Holyoke, Mass.	600,000	Southampton	800,000
Bridlington (Second)	200,000	Hull	1,500,000	Southampton (Second)	500,000
Brighton	1,750,000	L. & N.W. Rly., Crewe	700,000	Southgate	400,000
Brighton (Second)	1,850,000	Lawrence, Mass.	400,000	Southport	750,000
Brussels—Forest	1,000,000	Lea Bridge	350,000	Southport (Second)	900,000
Brussels—Ville	750,000	Lea Bridge (Second)	350,000	Stafford	500,000
Brussels—Ville (Second)	750,000	Liége, Belgium	1,000,000	Staines	600,000
Brussels—Ville (Third)	1,500,000	Lincoln	500,000	Stockport	600,000
Carlisle	600,000	Liverpool	3,500,000	Stockport (Second)	600,000
Chorley	300,000	Liverpool (Second)	4,500,000	Stockton-on-Tees	500,000
Commercial Gas Co.	850,000	Longton	600,000	Swansea	750,000
Commercial (Second)	850,000	Magdeburg, Germany	1,400,000	Swansea (Second)	1,000,000
Commercial (Third)	1,250,000	Maidenhead	225,000	Sydney—Harbour	500,000
Commercial (Fourth)	2,000,000	Maidenhead (Second)	225,000	Sydney—Harbour (Second)	500,000
Copenhagen	700,000	Malta	400,000	Sydney—Mortlake	500,000
Copenhagen (Second)	2,500,000	Manchester	3,500,000	Sydney—Mortlake (Second)	500,000
Coventry	600,000	Manchester (Second)	3,500,000	Syracuse, N.Y.	850,000
Coventry (Second)	600,000	McKeesport, Pa.	500,000	Taunton	225,000
Croydon	1,250,000	Merthyr Tydfil	300,000	The Hague, Holland	1,000,000
Croydon (Second)	625,000	Middlesbrough	1,250,000	Tilburg, Holland	400,000
Croydon (Third)	625,000	Newburgh, N.Y.	350,000	Tottenham	750,000
Deventer, Holland	150,000	Newburgh (Second)	250,000	Tottenham (Second)	750,000
Deventer, Holland (Second)	200,000	New York	1,200,000	Tottenham (Third)	350,000
Dorking	150,000	New York	4,000,000	Tottenham (Fourth)	1,000,000
Dublin	2,000,000	North Middlesex	150,000	Tunbridge Wells	1,000,000
Dublin (Second)	2,000,000	North Middlesex (Second)	200,000	Utrecht, Holland	1,000,000
Dunedin, N.Z.	150,000	Norwich	1,000,000	Utrecht, Holland (Second)	1,000,000
Dunedin, N.Z. (Second)	275,000	Ostend, Belgium	100,000	Waltham	400,000
Durham	200,000	Perth, W.A.	125,000	Wandsworth & Putney	1,800,000
Eastbourne	1,250,000	Port Elizabeth, S.A.	400,000	Watford	300,000
Edinburgh	2,000,000	Portsmouth	1,000,000	Watford (Second)	350,000
Epsom	225,000	Posen, Germany	450,000	West Ham	1,500,000
Falmouth	150,000	Posen, Germany (Second)	700,000	Winchester	225,000
Faversham	200,000	Preston	1,400,000	Zwolle, Holland	200,000

AND WORK UNDERTAKEN SINCE JANUARY 1, 1904.

Taunton (2nd)	350,000	West Ham (2nd)	800,000	Alkmaar, Holland	400,000
Bognor	100,000	Brieg, Silesia	100,000	Leiden, Holland	500,000
Bournemouth (2nd)	500,000	Brussels—Ville (4th)	350,000	Poole	1,500,000
Vienna	3,500,000	Innsbruck, Austria	200,000	Berlin-Rixdorf	650,000
Maastricht, Holland	200,000	Marlborough	100,000	Berlin-Charlottenburg	2,500,000
Antwerp, Belgium (2nd)	1,000,000	Flensburg, Sleswig	300,000	Bochum, Westphalia	530,000
Tottenham (5th)	1,000,000	Weston-super-Mare	300,000	Brussels—Anderlecht	350,000
The Hague, Holland (2nd)	500,000	Wexford, Ireland	100,000	Leigh, Lancs.	350,000
Hampton Court	500,000	Budapest, Hungary	50,000	Stockport (3rd)	400,000
Lea Bridge (3rd)	400,000	Swindon	300,000	Agram, Croatia.	200,000
Dublin (3rd)	650,000	Reading	1,000,000	Bruges, Belgium	200,000
North Middlesex (3rd)	75,000	Oberhausen, Germany	175,000	Liége, Belgium (2nd)	750,000
St. Gallen, Switz. (2nd)	225,000	Malmo, Sweden	350,000	Lemberg, Galicia	260,000
Brussels—St. Josse	1,000,000	Ipswich	750,000	Leeuwarden, Holland	400,000
Dundee	1,500,000	Winchester (2nd)	125,000	Stockholm	1,500,000
Bridgwater	200,000	Zwolle, Holland (2nd)	200,000	Romford (2nd)	350,000

HUMPHREYS & GLASGOW TOTAL . . **164,600,000** CUBIC FEET DAILY.
UNITED GAS IMPROVEMENT CO., U.S.A. **473,200,000** CUBIC FEET DAILY.
TOTAL 637,800,000 CUBIC FEET DAILY.

36 & 38, VICTORIA STREET, LONDON, S.W.
Telegrams: "EPISTOLARY LONDON."

UNITED STATES OFFICE:
31, NASSAU STREET, NEW YORK.

CONTENTS.

EDITORIAL NOTES.

GAS, &c.—

Board of Trade Returns of Gas Undertakings 631
Mr. C. E. Brackenbury on Contracts and Specifications 631
The Value of Condensation 632
Technical Commercialism 632
The Autocratic Builder 633
Electricity Evicted from the Public Lamps at Wellingborough—The Midland Junior Association—Lively Mond Gas—The Position of Trade Unions 634

Gas Stock and Share Market 635
Electric Lighting Memoranda 635
The Plaissetty Inverted Mantle 637
West's Rotary Projector and Ram Discharging-Machine at Bristol 638
Society of British Gas Industries . . . 640
After Fifty-Five Years' Service 640
Notes on Gas-Fires from a Consumer's Standpoint. By F. H. Leeds, F.I.C. 642
Some Legal Notes on Contracts and Specifications. By C. E. Bracbenbury, Assoc. M.Inst.C.E. 644
Explosions of Coal Gas and Air 647
Gas-Engine Indicators 647
The Use of Carburetted Water Gas in the Bunsen Burner. By Masumi Chikashige . 648
Midland Junior Gas Engineering Association—Mr. W. E. Caton on Work with Illumination and Street Photometers 649
Flame. By C. M'Pherson 652
Purifier Covers and Rapid Fasteners. By Thomas S. Clapham 655
Manchester Junior Gas Association . . . 656
Some Thoughts on Condensation. By J. S. M'Ilhenny, of Washington 657
Electrolytic Action and Gas-Mains . . . 660

CORRESPONDENCE.

Hydraulic Apparatus for Operating the Valves of Coal-Measuring Chambers at Tottenham 662
Gas as a Means of Ventilation 662
Purification Results at Chester and Stretford 662
Gas Mains and Electric Cables 662
The Future of the Gas Profession 662
Gas *versus* Electricity 663

PARLIAMENTARY INTELLIGENCE.

Progress and Grouping of Bills 661

LEGAL INTELLIGENCE.

Supreme Court of Judicature—Court of Appeal—The Ilford Flood Actions 663
Cardiff Gas Company's Assessment—Appeal to Quarter Sessions. 663
Bristol Gas Company's Regulations—Lead *v.* Iron Connecting Pipes. 664
The Pollution of an Edinburgh Brewery Well 665
Embezzlement by a Water Collector . . . 665

MISCELLANEOUS NEWS.

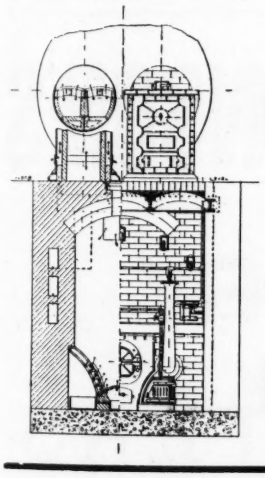
The Croydon Purifier Contract 663
Jubilee of the Coal-Tar Colour Industry . . 665
West Ham Gas Company 666
South Shields Gas Company 667
Provincial Gas and Water Companies . . . 667
South Staffordshire Mond Gas Company . . 670
Gas, Water, and General Investment Trust . 671
Reading and the Sulphur Question . . . 671
Sulphur Question at Hastings 671
Public Lighting of Brighton 671
Public Lighting of Stanley 672
Metropolitan Water Board — Revision of Charges; Formation of a Law Department 672
Notes from Scotland 672
Current Sales of Gas Products 673
Coal Trade Reports 674
Wentwood Water Scheme at Newport (Mon.) 675

MISCELLANEOUS NEWS (*continued*)—

Theft of Gas-Fittings 675
Scott-Snell Lamps for Bethnal Green . . . 675
Patent Notices 678
Stock and Share List 679

PARAGRAPHS.

The Transactions of the Institution of Gas Engineers 634
Obituary and Personal 636
Standardization of Harcourt Pentane Lamps 637
Sanitary Value of Water Analysis — The Woodall-Duckham Vertical Retorts. . . 643
The Electric Light and Eyesight 648
Fiddes-Aldridge Machine-Stoker at Liverpool 656
The Ventilating Value of Gas 661
Sulphur Compounds at Coventry 667
Gas Profits at Burnley—Gas Profits at Belfast 670
Sales of Shares. 672
Tampering with a Gasholder—Gas for Power Purposes at Wellingborough 675
Price of Gas at Halifax—Incandescent Gas for Lighting Swimming Baths—Proposed Purchase of the Blyth Water-Works—Suicide by Gas—New Gas-Works at Billingshurst—Public Lighting of Coventry—Bradford Gas Finances—Offering Facilities to Consumers at Holywood (Co. Down)—Management of the Paris Gas Supply—New Joint-Stock Companies 676
Price of Gas at Gloucester—Gas Preferred to Electricity at Accrington—Proposed Purchase of the Garw and Ogmore Water-Works—Free Public Lighting at Dewsbury Chard Gas Supply—The Suicide of a Gas Manager—Quality of the Gas at Nottingham—Mr. Stelfox's Report on Gas Complaints—Getting up a Testimonial . . 677
Burnley Water-Works Extensions—Birmingham Water Supply—Unlawfully Connecting Water Supplies—Large Sale of Water Annuities—The Cost of Public Lighting at Barnstaple 678



HISLOP'S

PATENT SYSTEM OF BOILER FIRING.

20 % Saving in Fuel.
20 % more Water Evaporated per hour.
Steady Steam Pressure.
Fuel Employed—Coal or Coke.

Perfect Combustion—17 to 18 % CO_2 in Waste Gases.
Producer Cleaned once in 24 to 48 hours.
Applicable to all Boilers.

INEXPENSIVE. DURABLE. SIMPLE.

DESIGNS AND ESTIMATES FROM

R. & G. HISLOP, 13, ST. JAMES PLACE, PAISLEY.

LONDON—87, VICTORIA STREET, S.W.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE.

RADIATE MORE HEAT

BY USING

SILCO BRICK RETORTS.

SILCO BRICKS prevent all settling of setting.

SILICA BRICKS for Combustion Chambers, any shape.

THOMAS GLOVER & CO.'S

PATENT NEW IMPROVED PREPAYMENT METER

For Pennies, Shillings, or any Coin.

Simple in Mechanism.
Positive in Results.
Price Changer *in Situ*.

GUARANTEED FOR FIVE YEARS.

Telegraphic Address: "GOTHIC, LONDON." Telephone No. 6159 Bank.

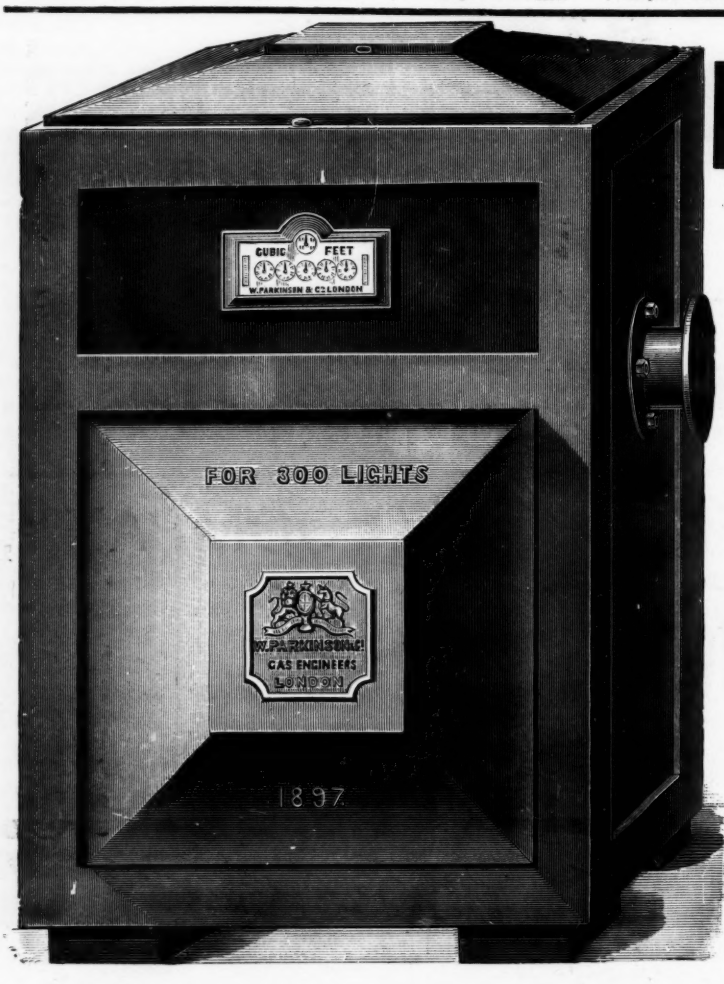
THOMAS GLOVER & CO., LTD.,

GAS-METER MANUFACTURERS,

LATE OF CLERKENWELL, NOW 49, QUEEN VICTORIA STREET.

Telegraphic Address: "GOTHIC, LONDON." Telephone No. 6159 Bank.

BRISTOL:	BIRMINGHAM:	MANCHESTER:	GLASGOW:	BELFAST:	MELBOURNE:
28, BATH STREET.	67 & 58, BROAD STREET.	132 & 134, CORN EXCHANGE BUILDINGS.	26, WEST NILE STREET.	8, EXCHANGE PLACE, DONEGALL STREET.	23, WRIGHT'S LANE, LONSDALE STREET.
Telegraphic Address: "GOTHIC."	*Telegraphic Address:* "GOTHIC"	*Telegraphic Address:* "GOTHIC."	*Telegraphic Address:* "GASMAIN."	*Telegraphic Address:* "GOTHIC."	
Telephone No. 1005.	Telephone No. 5009.	Telephone No. 3898.	Telephone No. 6107 Royal.		Telephone No. 3716.



PARKINSON'S

DRY METERS

ALL SIZES KEPT IN STOCK.

PARKINSON AND W. & B. COWAN, LTD.
(*Parkinson Branch*).

COTTAGE LANE, CITY ROAD, LONDON.

BELL BARN ROAD, BIRMINGHAM.

JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. XCIII., No. 2234.—TUESDAY, MARCH 6, 1906.

EDITORIAL NOTES—GAS, &c.

Board of Trade Returns of Gas Undertakings.

THESE somewhat belated returns were noticed in last week's "JOURNAL," when attention was drawn to some of the principal features revealed in them. Their appearance is always awaited with considerable interest, and no publication of the kind relating to the gas industry—with the single exception, perhaps, of "Field's Analysis"—is more often quoted. They are indeed invaluable for reference, and are rightly regarded as an authoritative indication of the progress made by the gas industry. It is difficult, indeed, to realize the fact that, comprehensive as they appear to be, they do not include one-half of the total number of gas undertakings carrying on operations within the United Kingdom, for the reason that they are confined to only such undertakings as are authorized. The number of these has increased since 1882 (the first year of the publication of these returns) from 500 to 734; but there still remain without the fold something like 866—the total number of gas undertakings being about 1600. But for the fact that this rather large majority of 866 consists mostly of very small works, the effect of their exclusion from the returns would inevitably be to limit the usefulness of the latter as a record. As it happens, the gradual inclusion of undertakings previously unfettered by parliamentary control, or which pass into the hands of local authorities, has a disturbing effect upon any comparisons that may be made from year to year.

The returns just issued include fifteen additional undertakings—ten belonging to companies, and five to local authorities. The purchase money for the latter doubtless includes the price paid for goodwill; but this can by no means account for the increase during the year in the aggregate capital of the local authorities from £642 to £660 per million cubic feet of gas sold. The comparatively small increase in consumption of 570,166 cubic feet is probably answerable for much of this, since extensions of works and expenditure on distributing plant do not uniformly—rarely, in fact—correspond with immediate demand. It is to be noted, however, that during the year the amount of capital redeemed by the local authorities was greater than ever before—namely, £762,710. So that, of a total of £38,512,295 invested, no less a sum than £10,189,194 has now been repaid or placed to sinking fund. For the same period the capital of the companies shows a reduction from £861 to £851 per million cubic feet sold. An interesting feature in the return relating to undertakings owned by local authorities is the amounts paid for interest on loans and for redemption of capital. These totalled for the year £1,738,682, which, on a sale of 58,324,570,000 cubic feet, works out at 7·15d. per 1000. There is, unfortunately, no corresponding column in the companies' return showing the amount of capital charges; but it would be safe to say that these exceed the last-mentioned figure.

On just one other matter, which is by no means without interest in this connection—namely, the prices charged for gas—the returns give very full information; and those who are interested in the question as to whether in this respect consumers are served best by companies or local authorities, may find in them plenty of material for a solution of it. But for the large majority of our readers, it may be sufficient to know that, according to these 1904 returns, the aggregate gross receipts of the companies amounted to 3s. 7·9d., and those of the local authorities to 3s. 3·3d., per 1000 cubic feet of gas sold. To what extent this may be due to lower prices for gas charged by the latter must be left to others to determine. It is to be noticed that while of the gas supplied by the companies nearly 14,000 million cubic feet, or 13·3 per cent., was carburetted water-gas, the local authorities made only 5000 million cubic feet of such gas, or 7·9 per cent. of the whole. As regards the latter, the unaccounted-for gas remains at 7·9 per cent.; while that of the companies increased during the year from 7·45 to 7·6 per cent. But the companies have increased their make of gas per ton by nearly 200 cubic feet—namely, from 10,369 to 10,560 cubic feet; while that of the local authorities remains at 10,369 cubic feet. Finally, the increase in gas sold—of under 1 per cent. in the case of the local authorities, as compared with an increase of 3·4 per cent. in that of the companies—may be said to reflect the depression of trade which prevailed throughout the year embraced by these returns, and chiefly affected the manufacturing districts in which most of the undertakings owned by local authorities are situated. An aggregate increase for the year, however, of upwards of 2½ per cent.—notwithstanding the economies secured to the consumer by the use of the incandescent mantle, although due to a slight extent to the inclusion of additional undertakings—cannot but be regarded as highly satisfactory. In fact, every column of figures in the comparative tables of these returns tells the same tale of steady and almost uninterrupted progress, and reveals the astonishing vitality of the gas industry, in spite of occasional adverse circumstances and the keen competition to which it is now subject on every side.

Mr. Brackenbury on Contracts and Specifications.

THE paper which was read by Mr. C. E. Brackenbury on Tuesday last at the meeting of the Society of British Gas Industries, will be studied with much interest, even by those who may not find themselves in entire agreement with it. It is, indeed, an exposition of the law of contracts in which the point of view of the contractor has a foremost place; and, although as such it will doubtless be of considerable service to those to whom it is addressed, it will hardly be recognized as dealing in every respect with the subject in (let us say) an absolutely impartial and judicial manner. It will to some be rather surprising in the first place to find Mr. Brackenbury (himself an engineer) assuming that the position of the engineer has changed, inasmuch as he now looks to the contractor to furnish drawings for the work which he desires to carry out. This may, here and there, be the case. But it is a practice that cannot be too strongly deprecated; and we venture to say it is within Mr. Brackenbury's own experience that it is not followed by any engineer of repute, unless with reference to specialities which may be a contractor's own invention or design.

It goes without saying that a contractor should have sufficient engineering skill to be able to form an estimate of the practicability or otherwise of a design for the carrying out of which he is invited to tender; and any objection that he may entertain should be lodged before, and not after, the contract has been entered into. It is equally apparent that the engineer should be competent for the work which he has undertaken; since, if he does not possess the necessary qualifications, not only may his designs be faulty, but his employer will be at the tender mercy of the contractor. We do not agree any more than does Mr. Brackenbury, with the substitution for efficient engineering of stringent—not to say, unfair—conditions; but a contract should in all cases be sufficiently binding to ensure due observance of the intentions of the engineer. There must, moreover, be a spirit of reasonableness on both sides, without which no business could be properly carried on; and it may safely be said that this spirit of reasonableness does prevail in the vast majority of cases. When it does not, contractors have it now in their power, through their Society, to make joint representations as regards the terms of any particular contract. But even the most terrifying conditions lose their potency in actual practice, and probably because of their severity they, like stage thunder, impose upon nobody. It is not in the power of any engineer to place himself above the law, although recourse to it is, for many cogent reasons, a desperate remedy for a contractor.

But it may be asked, Are there not some contractors who

assume obligations—as to time of completion, for instance—without any very definite ideas of fulfilling them? Many there are, no doubt, who will decline to tender if in their judgment the time given for completion is not sufficient; others, however, take their chance of the penalty clause not being enforced. Some few, too, take pride in earning for themselves, as opportunity offers, the title of "lightning" contractors. Mr. Brackenbury seems to be under the impression that it is a very common thing to enforce penalties. There is good ground, however, for doubting the accuracy of this, and for asserting that, on the contrary, penalties for non-completion within the time specified are seldom enforced. But are there not occasions when it would be but simple justice to enforce them? The case of the Tottenham and Edmonton Gas Company, which was referred to by Mr. Corbet Woodall at the recent meeting of that Company, may be referred to as an illustration. Here, owing to delay on the part of the Contractors in the execution of a very important extension of the works, a large amount of capital was lying idle during the busiest part of last winter; and all the retorts available had to be kept going for several days in succession—there not being a single spare one. Many of the settings, too, that the Company were in consequence of delay compelled to use were in bad condition, which resulted in uneconomical working. Had the weather not been comparatively mild and open, the condition of affairs must have been much more serious. In any such case, it is surely in the power of a contractor to judge before committing himself to a contract whether he can complete it within the time specified, and act accordingly. He has to consider his position in regard to other existing obligations, and also the prospect of his obtaining the necessary materials. It is, in fact, for him to decide whether to try for it, or to pass it by. But, if he does try for it, it should be with the honest intention of observing the time-limit. This matter stands upon quite a different footing from other conditions—perhaps stringent enough in their way—as to which he may not unreasonably rely upon the sense of fairness of the engineer.

As regards specifications, it may be remarked that the more the drawings to which they relate are allowed to speak for themselves, the better; for no good is done by repetition. What is chiefly wanted in the specification is that which drawings cannot supply—that is to say, the description of the material to be employed, and the manner in which the work is to be executed.

The Value of Condensation.

The very suggestive paper, entitled "The Condensation of "Gas," which was read at the recent meeting of the American Gaslight Association by Mr. James M'Ilhenny, and is reproduced elsewhere in these columns, will be read with interest, and recognized as fully confirming the evidence which has been continually accumulating in this country as to the effect of condensation upon naphthalene deposits. The author, in fact, goes so far as to say that "with the "principles of divisional condensation perfectly carried out, "troublesome stoppages could be entirely obviated, and the "maximum candle power retained in the gas." Included in "troublesome stoppages" are, however, frozen services and liquid deposits in pipes and meters, with which, except during unusually severe weather, gas-works managers in this country are not greatly troubled; and therefore the proposed remedy for them is not likely to appeal strongly to them. Briefly, this may be stated to be an appreciable reduction of the temperature of the gas prior to its entering the distributing mains, with the object of removing as much as possible of the aqueous vapour held in suspension by the higher temperatures. This is to be effected by the sinking of wells to a depth that would ensure uniform temperature, and by passing water in a coil down these wells for use in a multitubular condenser through which the gas would be passed. The crudeness of this idea, and its manifest insufficiency as a remedy for (say) frozen services, are no hindrances to an acknowledgment of the possible benefit to be derived from what the author terms "divisional condensa-"tion" in the prevention of naphthalene deposits. For, as explained by the author, this seems to amount to but little more than the effecting of condensation by stages, and the removal of condensable matter, and providing a sufficient extent of frictional contact.

Divisional condensation practically answering this description is effected in any ordinary form of vertical condenser from which the tar and liquor are drawn at each pipe or set of pipes. So far, therefore, the author does but little more than advocate greater thoroughness of condensation than is occasionally practised on that side of the Atlantic. The necessity for this seems to be apparent from the mention by one speaker in the discussion which followed the reading of the paper, of a temperature of 105° to 110° Fahr. at the inlet of the purifiers. This relates, it is true, to carburetted water gas; but with inadequate condensation in connection with this gas, managers in this country are not wholly unfamiliar. It is not therefore altogether surprising to learn that the relief holder, which was instituted for a totally different purpose, is credited with playing a not unimportant part in the work of condensation. What does give ground for some reflection is the fact that similar credit is accorded to coal-gas relief holders. Such holders are quite unknown in this country in connection with the manufacture of coal gas; and their use as a means of condensation can hardly be commended on the score of economy as regards plant. It is, however, quite conceivable that very effective separation of tarry particles from the gas might be brought about by confining the latter for a time within a gasholder of adequate dimensions. This is indeed an old idea—much talked about, and to a certain extent acted upon in the early seventies of the last century. About the same time, also, relief began to be experienced from the employment of longitudinal condensers, which first assumed the form of a main carried round the inside and outside of the retort-house.

Further investigation indicated the desirability of separating the first products of condensation, which included the thickest tar, early in the process, or so that the gas should not be brought into contact with the latter when at a lower temperature than (say) 90° Fahr.; while it is now recognized that prolonged contact with the lighter portions of that which ranks as tar, or, to speak more correctly, perhaps, retention in the gas of some of the lighter hydrocarbons which ordinarily find their way into the tar-well, is essential for the prevention of naphthalene deposits. To find out the means by which this object can be effectively secured, is the task which the Naphthalene Committee of the Southern District Association, with the able assistance of Dr. Colman, have set themselves to accomplish—a task which is rendered more difficult by the varying composition of the tar produced by the different varieties of gas coal. But that there is in most cases a sufficiency of solvent for the prevention of naphthalene deposits is almost beyond doubt; the question is, how to bring it into effective contact with the gas. In the meantime, the only really effective method of preventing these deposits is by washing the gas with solvent oils, as is practised by Mr. Bell at Derby, and by Mr. Colson at Leicester. But belief in the possibility of devising a satisfactory automatic process is distinctly encouraged by experiences such as those of Mr. M'Ilhenny.

Technical Commercialism.

The proceedings of the Society of British Gas Industries last Tuesday completed the organization of that body, with the exception of the appointment of the first President, It has its Council, its Honorary Secretary, its Honorary Treasurer, and its Secretary, and is properly equipped for taking active part of its own initiative and, conjointly with other organizations of the industry, in any work that may be to the general advantage. The members of the Council who will hold office for the first year are, as our report elsewhere shows, representative of the component parts of the side of the gas industry whose business is contracting, the production of special plant and apparatus, the manufacture of the appliances—domestic and industrial—that are required for the utilization of gas, and the production and supply of the miscellaneous needs of gas-works. It is therefore a Council who can be approached in anything that appertains to the common-weal, whose decisions and doings will be treated with respect, and to whom and through whom representations can be made. In other words, a void that has existed has now been filled; and fresh means have been provided for constructive and helpful service.

The members of the Society have made it abundantly plain that their objective is that of every other organization in the gas industry, though in some respects—their commercial interests having their origin in different directions but ending in the requisites for gas manufacture, distribution, and consumption—their work will open up new ground for

their own collective consideration. But on that ground, too, while looking after their own interests, they will also be serving the interests of the whole industry. Sir George Livesey was urging the other day that the gas industry should not tamely submit to the new demands of the Durham coal owners. There are other markets (although perhaps not so important) in which gas manufacturers are directly concerned, but with which they have not such intimate dealings. We may take, as an example, the metal markets. In them gas-works contractors and makers of plant and appliances are constantly doing business; and in them therefore they can serve—sometimes perhaps better collectively than individually—the interests of the whole gas industry. Reasons sufficient have been advanced on various occasions to show that the hand of friendship should be extended to the new Society, and the utmost use be made of it. As was said by Mr. C. E. Brackenbury, in the skilfully composed paper with which the work of the Society was inaugurated, "the internal history of the gas industry "might have been very different during the last twenty or "thirty years had such an organization as has just been "formed been in existence." Without much consideration, the truth with which these words are impregnated will be apparent. The main theme upon which Mr. Brackenbury discoursed is the subject of comment elsewhere; and the paper itself is published in other columns. It is convenient to mention here—although, coming in such close connection with the reference to Mr. Brackenbury's contribution, it must not be supposed to have any special application—that it is not be taken that the views expressed by any author of papers presented to the Society will necessarily reflect the opinions of the Society as a body, any more than papers before other associations on technical topics can be taken to represent the experiences, the preferences, and the opinions of the whole of the members.

While welcoming the new Society of British Gas Industries, it is a pleasure to be able to allude with satisfaction to the effective start made by the American Commercial Gas Association, whose work is to be devoted exclusively to the department of gas undertakings whose especial function it is to promote business in, and not to make, gas. The whole of the conferences will be given up to the consideration of experiences and suggestions bearing upon the official work of the members; and on the principle that in all these things two or more heads are better than one, much good may be expected to ensue from these opportunities for taking counsel together. The opening proceedings were noticed in our issue for Feb. 20; and it will be seen from the President's address that the organization has a programme of sound usefulness on which to operate. In competitive business, no work that will contribute to success should be scouted. There has been, at the very outset, an attempt in one quarter to pick the American Association to pieces on points of detail and incidental remark. This lacks generosity. All ordinary notions of fair play would suggest an open field for trial and the most liberal encouragement. If the Association did not then justify its existence, the critic could allow himself the pleasure of assisting in bringing to an end a useless endeavour. There are many new things upon the surface of which it is easy to make scratches, without in the least degree injuring their utility.

The Autocratic Builder.

In the residential parts of Surburban London, a great change is now in progress. Property owners everywhere are complaining of the exodus from the older type of dwelling to the newer class (albeit much of it is "jerry-built," and with limited accommodation), of genteel and attractive exterior, and possessing all modern conveniences and sanitary arrangements. The occasional lamentation of the unemployed who has applied for work, and has been met with the "too-old-at-"forty" answer, given with a callousness that sends him out again into the unsympathetic world feeling almost that he had committed some crime in having advanced thus far in years, is also the cry of property owners in Suburbia. "Too "old at forty" is the objection to the property in which his capital lies invested. Forty years ago was a period of great and rapid building of the style of house—now scorned—in which basement apartments were considered correct things. Then the right place for the domestic servants by day was considered to be below ground; by night, immediately under the roof. The domestic servant has since revolted against the torture of many stairs, and against sundry other things; and means of labour-saving have had to come to the aid of the much-harassed mistress in the suburbs in effecting a compromise with her maids. This has brought about the demand for houses of the type which are self-contained on two floors; and to meet that demand, the stolid, drab streets of the districts of Outer London are being begirdled by the new class of houses, many of which are being erected by builders who do not build as did their predecessors. It is to the new class of houses that attention has to be directed.

It has been found, in different districts, just recently, that quite large numbers of these houses have been, during construction, wired throughout for electric lighting, and that in some of them there is not a vestige of a gas-pipe. This is a subject that was referred to at the meeting of the Bromley Gas Consumers' Company on Tuesday week. But that Company, in having newly erected houses in their district that are so furnished with electric wires, and not gas piping, are not an exception. Houses similarly pledged and restricted to electric lighting have been found in other companies' areas; and the South London district may be singled out. It is not suggested for a moment that this is the fault of the gas companies concerned, or of their officials. They are quite alive to this growing policy of electric suppliers to run electric wires, free of expense to the builder, into all new houses; and we have no doubt that in most, if not all, cases gas directorates are quite prepared to do the necessary gas-piping free of expense to the builder (or contribute part of the cost) if he will permit them to do so during erection. There would, of course, be a certain amount of dead-capital represented in this direction; but a contrary policy would produce loss of custom. And it would indeed be a "penny "wise and pound foolish" policy to lose customers for the sake of the comparatively modest cost that would be involved in the piping of new houses. Provincial companies, too, are not without their similar experiences; and they also find that energetic action is needed to bring about correction. Only the other day at the meeting of the Bournemouth Gas Company, Mr. Corbet Woodall mentioned that, two years ago, an investigation in the town showed that, of the houses that were then being built, not one of them was being provided with gas-pipes. The discovery was followed by activity. For the gratifying result, we refer readers to the report of the proceedings at the Company's meeting, as published last week. But it is not in all cases that gas directors have learnt that there has been a passing from the state of monopoly to that of keen competition.

On the main question, however, the chief obstacle to success, in certain instances, in getting permission to pipe houses is the builder-landlord himself. He is, it is occasionally noticed, an individual who gives his tenants as little preference as possible. It is as much as he can be made to do to give them the choice of wall covering and decoration. And now, in cases, he is autocratically claiming the right to determine the system of lighting that his prospective tenant is to enjoy and to pay for. This is assuming a prerogative that, carried farther, would enter upon the private right of the tenant to say what he shall eat, what he shall drink, and what he shall wear. The electricians—no doubt, on the principle that "everything is fair in love and war"—have been working on the credulity of builders with pretty stories as to the protective power of electricity in respect of fire and decoration; and builders have been found willing, on the baseless fabrics of electrical visions, to depreciate the value of their houses to the tenants by committing them, whether or not it is their pleasure, to one, and that an expensive, form of lighting. If landlords would, where they allow electric wiring to be done during erection, also permit gas-piping to be put in, it would often avoid an after-cutting of the walls, and, what is more, would allow every tenant to indulge his preference in regard to illumination. It is really to the interest of the builders to grant the maximum of possible conveniences rather than arbitrarily delimit them, as in the several houses in which this kind of thing has recently been noticed.

Every effort must be, and we have no doubt is, made to break down, wherever it occurs, this absurd attitude of those builders whose modernizing views have not soared beyond the electric glow lamp for residents in New Suburbia and elsewhere. Modernization and economy should, as often as efficiency will allow, go hand in hand; and to this no one who has a house to let or sell should object. The "empties" in the streets where are situated the old type house once so much

sought after, are on the increase; their increase means loss of gas business in those streets. To compensate for that loss, the tenants must be—not followed as of old, but preceded, and no advantage must be granted the competitor in point of facilities. Once walls are covered up with only electric wires embedded in them, it may be concluded that, for some time at any rate, incandescent gas-burners will have no part in the lighting of the house; and then, except perhaps in regard to gas required for cooking and heating, the power which the householder possesses in section 11 of the Gas-Works Clauses Act of 1871 might just as well be non-existent.

Electricity Evicted from the Public Lamps at Wellingborough.

In our "Electric Lighting Memoranda" will be found the story of the rise and fall of electricity for public lighting in Wellingborough—a tender by the Gas Company having been accepted for the lighting of the whole of the streets by incandescent gas-lamps for seven years. The success is not a small one, as 135 electric lamps are involved; and these will be displaced as from July 1 next. A peculiar feature of the bargain is that the Gas Company will now take over the work of refuse destruction for the town; and the destructor will shortly be removed from the Council's land to the Union Road gas-works. Gas companies have it within their power to be very accommodating to local authorities. They can help them to economy and efficiency in one of the most important departments of the public service—the street-lighting; and, as the enterprising Wellingborough Gas Company are going to show, they can serve a town in assisting in the maintenance of a good sanitary condition. The experience of the Wellingborough Council has disgraced in their eyes dust-destructors as being effectual means of cheapening electricity generation. For them the dream of "electricity for nothing" has soon passed.

The Midland Junior Association.

The members of the Midland Junior Gas Engineering Association had a specially interesting programme prepared for last Saturday's meeting; and it can only be regretted that the members did not turn up in greater numbers to enjoy the fare that was provided for them. It is to be hoped that the falling off in the attendance was due to some purely transitory cause, and not to a lessening—even in the very smallest degree—of interest in the work of the Association. There were two papers read, both of which, with a report of the discussions thereon, appear in to-day's issue. The first was by Mr. W. E. Caton, of Derby, on "Illumination and Street Photometers." In this the author referred to the illuminating power photometer described three years ago by Mr. Henry Fowler, in a paper which he read before the Manchester District Institution of Gas Engineers; and he also gave an account of the Simmance-Abady street photometer. The discussion, however, turned largely upon tests made by Mr. Caton in the streets of Derby, in which some very striking discrepancies between the nominal and actual illuminating power of the electric lamps were revealed. Mr. Caton's paper was very appropriately followed by one on "Flame," which was read by Mr. C. M'Pherson, of Nechells. This was accompanied by numerous experiments and an effective display of incandescent gas-lamps on the various systems now in vogue. Mr. M'Pherson went to a great amount of trouble in fixing up his apparatus at the place of meeting, and in successfully carrying out his experiments; and he was rewarded for his pains by the hearty applause of those members who were fortunate enough to be present. Altogether the meeting was one of the most interesting the Association have held; and all who took part in the proceedings are entitled to congratulation.

Lively Mond Gas.

Careful readers of the "JOURNAL," at all events, will not be altogether surprised at the difficulty so far experienced by the South Staffordshire Mond Gas Company in profitably conducting their business; but the report which was noticed recently seems to have astonished some of the shareholders, judging by remarks that were made at the meeting. Even after making allowance for the fact that operations have so recently been started by the Company, the debit balance on the past year of practically £9000 is anything but a good showing. In fact, one proprietor, who was particularly frank in his criticisms, questioned whether the Company "were not going to the dogs as rapidly as they could." He pointed out that the amount paid by the Company for coal and water was some hundreds of pounds more than the receipts from gas and residuals; but this no doubt is owing to some extent to the arrangement by which the Mines Drainage Commissioners are taking a portion of the output (which is "not being supplied at a profit"). Manufacturers are stated to have shown a good deal of scepticism as to the practicability of the scheme; and it is their extreme slowness in coming forward as consumers that has obliged the Company to supply the Mines Commissioners at these special rates, in order to obtain the minimum load necessary to the proper manipulation of the plant. One proprietor drew attention to a matter that seems hardly likely to banish this scepticism—namely, that while the Company were asking people to buy gas to fire their boilers, they were using slack under their own (and at the same time, we may add, getting rid of the gas, which is "not being supplied at a profit," to the Drainage Commissioners).

The Position of Trade Unions.

The recently issued reports of the Royal Commission on Trade Disputes and Combinations, which were noticed in last week's "JOURNAL," have once more drawn attention to the position held by Trade Unions since the Taff Vale decision, though this reminder was perhaps hardly needed, for the parties most concerned are not likely to let the matter drop out of sight for any length of time, if they can help it. In fact, already in the present session a Bill has been presented by Sir Charles Dilke, supported by Mr. Keir Hardie, to amend the law relating to Trade Unions and trade disputes. The object of the Bill is to completely restore Trade Unions to the legal position in which "they were intended, and until recently understood, to stand;" and it only differs in one clause from the Bill introduced by the same members two years ago. Last year a Bill having the same title, but presented by another member, was referred to a Standing Committee of the House of Commons; and a clause dealing with peaceful picketing was passed by the Commons, with an addition. The words of that clause, as proposed, have been adopted on the present occasion. The Bill is a very short one; the clauses being to the following effect: (1) Where an act is done in contemplation or furtherance of a trade dispute, the person doing the act shall not be liable to an action on the ground that by that act he interfered, or intended to interfere, either with the exercise by another person of his right to carry on his business or with the establishment or continuance of contractual relations between other persons. The section, however, will not exempt such person from liability on any other ground. (2) An agreement or combination by two or more persons to do, or procure to be done, any act in contemplation or furtherance of a trade dispute shall not be ground for an action, if it is not when done by one person. (3) An action shall not be brought against a Union, or persons representing the members, in their representative capacity. (4) It shall be lawful for persons, acting on their own behalf or on that of a Union or other association, to attend before or during any trade dispute at or near a place where a person resides or carries on his work, for the purpose of peacefully obtaining or communicating information, or of peacefully persuading any person to work or to abstain from working.

The Transactions of the Institution of Gas Engineers.

By the title-page of the Transactions of the Institution of Gas Engineers for 1905, we are reminded that last year the annual meeting was held on May 30 and June 1 and 2. The larger part of the contents of the volume consists of a report of the proceedings at that meeting; and as the report as it appears in the volume was practically all in type, and the illustrations prepared, early in June, there seems to have been, so far as can be judged, an unreasonable delay in the issue of the volume—the copy before us having only been received as we were going to press yesterday. There might surely be a little more expedition displayed. In point of the quality of the contents, there is no doubt the volume will compare well with preceding ones; and the Ex-President Mr. D. Irving), whose photograph graces the volume as frontispiece, may look with pardonable pride upon this record of the technical work accomplished during the year of his presidency. As an appendix to the annual proceedings, there are a number of extremely useful abstracts of published work on chemical subjects, prepared by Mr. A. V. Hendrickson. But it may be suggested that, by a little alteration, the heading adopted might be made to accord with fact. The volume has been produced under the painstaking editorship of Mr. Walter T. Dunn, the Secretary of the Institution.

THE GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 679.)

THINGS were not all *couleur de rose* on the Stock Exchange last week. The first disagreeable factor was the closing of the accounts of a deceased operator, whose affairs were considerably entangled. Then the persistent gloom lowering over Moroccan and South African proceedings found nothing to dispel it. Thus at least the first half of the week was dull; but gradually the darkness began to lift. Even an idea began to get about that things at Algeciras were not quite so utterly at a deadlock as they were represented. And so before the close, the tone had quite changed; and buyers were actually found to be coming in. The course of the Money Market was also irregular. The tendency was easy at first; but it soon began to grow considerably tighter. This gave way again after lasting two or three days; and the condition at the finish was easy. Business in the Gas Market had a perceptible revival from the semi-dormant state into which it had fallen the week before; and not only were the big issues conspicuously active, but several of the lesser order which had been lying almost stagnant were now revived into action. A number of quotations made fair improvement; and only two or three showed a slight shrinkage. In Gaslight and Coke issues, the ordinary was very active, but not quite so firm. The best price was 99⅞ on Tuesday, after which it began to give way. On Friday, the price jumped about from 95⅝ to 99⅞, and then fell back again; and on Saturday it ranged from 98½ to 99¼. The secured issues met with no support. Nothing was done in the maximum; the preference could not improve upon 107, and so fell back a point; and the debenture was done at 88 free and 89. South Metropolitan was more active; and the price was steady and unchanged. Transactions were at from 128½ to 129½. There was one bargain in the debenture at 88. Dealings in Commercials were marked at 114 and 115 for the 4 per cent., at 111 for the 3½ per cent., and at 85 free and 85¼ for the debenture. The Suburban and Provincial group were more animated than they have been for a long while. Alliance and Dublin old advanced half-a-point. Bournemouth "B" changed hands at from 17⅛ to 17½; and Brentford old and new were done free at middle prices—262½ and 194⅓ respectively, and ditto debenture rose 2. Brighton original marked 234½, British was active at 43¼ and 43⅜, Bromley "A" marked 120½, and ditto "B" 91¼ (each issue advancing 1), and West Ham ordinary was done at 107 and 108. Tottenham "A" and "B" advanced 2 each; and, on the local Exchange, Newcastle scored a fractional advance. In the Continental Gas Companies, Imperial recovered a point, and marked from 234½ special to 235½, Union was dealt in at 132 and 130⅛ [a fall of 1], and European fully-paid at 22½ and 22⅛ [a fall of ⅛]. Tuscan marked 10¼. Among the undertakings of the remoter world, Bombay realized 6⅞; and ditto part-paid, 4 15/16. Cape Town 17⅜ and 17⅛, Buenos Ayres 12 1/16 and 12¾, ditto debenture 98¼ and 98½, Primitiva from 7 3/32 to 7¼, ditto preference 5⅜, ditto debenture 98½ and 99, River Plate from 13 to 13¼, ditto debenture 98½ and 99.

The closing prices are shown in our Stock and Share List on page 679.

ELECTRIC LIGHTING MEMORANDA.

The Conversion of Wellingborough—The Gas Company Eject Electric Lighting from the Streets, and Become the "Destructors" of the Town's Refuse—Brighton's Dissatisfaction with the Maximum-Demand System of Charging—The Warning Lights on Trolley-Wire Poles.

IT is an entertaining story, and worth the telling, of how the Wellingborough Gas Company have succeeded in capturing, in fair competition, the whole of the new contract for the street lighting of the town, and so have despoiled the Electric Light Company of the lighting of the 135 street-lamps which they at present supply with current. Old as the Wellingborough Gas Company are, it cannot be alleged that their acumen in manufacture and business is not of the most up-to-date order; and it is their sagacity in driving a bargain, and in proving efficiency, that have secured to them the whole contract for public lighting for seven years, and has constituted them the destructors of the town's refuse for a similar period. In the latter respect, they occupy a unique position; but it is an adjunctive piece of business that they cheerfully take upon themselves as part of their bargain, and to relieve the District Council of a little difficulty that the Electric Light Company were equally willing to shoulder. The records of Wellingborough tell us that in the year 1902 the District Council decided, on the advice of the then Surveyor, to erect a modern refuse destructor. Dreams were dreamed; and castles were built in the air. The heat units obtained from that destructor of the town's refuse was going to produce steam, and the steam was going to be the means of generating electrical energy for lighting—at "no cost" to the town—the public lamps. In other words, from that which was gross was to be produced a beautiful radiance, which was to brighten the streets of the town, and to assist the footsteps of the townsfolk during Nature's hours of darkness. The sequel of the tale is in the reversion of the whole of the public lighting contract to the Gas Company. But there is the part of the story between 1902 and the present time. It should first be explained that the District Council have powers to supply electricity for the public lighting and for their own buildings; while the Electric Light Company have powers to supply electricity generally. When the latter were applying for powers, the District Council gave their consent, and made an agreement with the Company that they (the Council) should have the use of the Company's cables for the distribution of their electrical energy at no charge to themselves—the Council also agreeing to let the Company have the use of land adjoining the refuse destructor for the purpose of erecting their generating station. But before the destructor was brought into use, the Council made another agreement with the Electric Company, under which they were to take electrical energy for the street-lamps from the Company; the latter on their part agreeing to pay for the "surplus" steam generated at the destructor works.

The cherished illusion of the Council was doomed to be quickly dispelled. A start was made in the connection of the lamps with the electricity cables in February, 1903; and ultimately 135 lamps were fixed in the main streets. Then there was a dead-stop, as it was found that the cost for electricity was much greater than that for gas, and also that the allowance for "surplus" steam was practically *nil*. When the account for the first year's lighting of the 135 electric lamps was sent in, the Council found that they had been misled as to the cost of lighting by electricity, as the following figures show:—

Lighting Account, April 1, 1904, *to March* 31, 1905.

	£	s.	d.
Electricity only, for 135 lamps	486	15	8
Gas only, for 278 lamps	356	8	11
Cleaning, lighting, and extinguishing the 413 lamps	238	15	5
Repairs	59	3	8
	£1141	3	8

Combined with the fact that for current only the 135 electric lamps cost £130 more than the gas for over twice as many gas-lamps, there were loud complaints as to the indifferent lighting by the electric lamps.

That was the second stage in the story; and, though the Council were astonished with the result of lending an ear to the dulcet voice of the electrical charmer, events showed that they were still prone to a little coquetting. It was the old, old story. Electricity for nothing or next to nothing; but in the end an unjustifiable expensiveness. Even then, it was difficult for them to publicly confess to being the victims of deception as to what could be done by a refuse destructor and electricity. Then in May of last year, both the Gas Company and the Electric Light Company were invited to tender for the lighting of the town; the tenders to be: (A) For lighting the whole town, (B) for the 135 lamps lighted by electricity, and (C) for the 278 lamps lighted by gas. Notwithstanding the assurance that the tenders were to be considered on their merits, the Gas Company were surprised some months afterwards to hear that the Committee were contemplating recommending to the Council the acceptance of the Gas Company's tender "C" and the Electric Light Company's tender "B." And well might the Gas Company be surprised, seeing that their total tender was between £100 and £200 below that of the Electric Light Company, in addition to which they were offering more light. Then it seems that the Committee and the Electric Light Company negotiated a little in respect of the refuse destructor. The Electricity Company, at the time they sent in their lighting tender, offered to work the destructor for the Council; the latter to pay for labour, repairs, &c. As this was not accepted, the Company offered to do the work for £100 a year, and ultimately for nothing, provided their tender for lighting was accepted. Their anxiety for the retention of the 135 electric lamps must have been keen. The Gas Company got wind of these proceedings; and a dignified protest (embracing some illuminating evidence to the cheapness and efficiency of incandescent gas lighting) was addressed to the whole body of councillors. But, to make a long story short, the matter was referred back to the Committee for further consideration. The Gas Company's opportunity had arrived. They at once erected some sample lamps, which were eloquent testimony of capability, and then gave serious consideration to the question of getting level with the Electric Light Company by taking over the refuse destructor. The issue was a tender for both lighting and refuse destruction. It was accepted—the inclusive price being £1200 per annum for seven years from July 1 next. The dust destructor is to be removed to the Union Road works of the Company, who will not feel any abasement if their friends choose to call them the Wellingborough Gaslight and Refuse Destructor Company. They have fought, and they have conquered; and that is sufficient for them. The town is to be lighted by 28 Welsbach 300-candle power self-intensifying lamps, and 385 No. 4 Kern burnered lamps, all fitted with automatic controllers. The contract includes gas, one-third new lanterns, lighting, extinguishing, cleaning repairs, &c.; including the destruction of refuse. The automatic controllers are provided by the Company, but form no part of the contract. The District Council now know definitely where they are, both in regard to the public lighting and the disposal of the refuse, and that they have not known since they dreamed of lighting their streets for nothing. It is written, "Buy truth, wisdom, and instruction;" but, verily, many local authorities are only following the advice in respect of the first and the last. But the wisdom!—well, the less said about it the better. In the case

of the Wellingborough Council, they are to be congratulated upon having—though the conversion was a tardy one—shown in the end their wisdom in the matter of public lighting. The very tardiness of their conversion, however, may make it the more lasting.

It was Brighton that gave birth to the maximum demand (or Wright) system of charging for electricity; it is Brighton that now condemns the system as a failure, and as, to the consumers, an unintelligible method of purchase. Brighton has not been happy in its municipal trading speculations, into which money is constantly being poured with the indefinite promise to the ratepayers that the infusion of the fresh capital will bring about a more profitable state of things. The disclosure made at the recent Local Government Board inquiry, of muddled and improvident finance in connection with the electricity undertaking, was a terrible blow for the local magnates and officials who have been trying to give this particular speculation a veneer of success. They have since, in the Town Council, endeavoured to whitewash the disclosures; but no one outside seems to have accepted their professions of financial stability and soundness of management with any seriousness. Facts are stubborn things; and the facts of the position at Brighton have been grasped by the ratepayers. The responsible councillors now find themselves confronted by a worse condition of things unless, by some stroke of good fortune, they can supplement, and that profitably, their business. The expectations as to the "ambitious" Southwick works scheme, which was to realize such economies that the inflow of new business would be irrepressible, have been unfulfilled; the old station is still on the hands of the Committee; new business evinces an increasing disposition to loiter; shopkeepers and private consumers have taken it into their heads that there is better value for money to be obtained by connection with the Gas Company's mains; and unpleasant comparisons are being made in the press as to the public lighting by incandescent gas-lamps at Hove and the lighting by electricity in Brighton, on the two all-important points of price and efficiency. In addition to these troubles, the maximum demand system is not liked; and in their distress at the dwindling rate of the undertaking's progress, the Electricity Committee, advised by their Resident Engineer, are hoping to stimulate things a bit by giving the consumers the option of taking their current on a flat-rate of 4d. per unit instead of on the maximum demand system of 7d. and 1d. The figures from Brighton are informative of how the dwelling-house consumers are the pack-horses of the undertaking. From private consumers, public lamps, and the municipal tramways, the total revenue from current last year was £81,798; and of this the private consumers paid £50,498 for 1,731,369 units at 7d., while the tramways only paid £11,350 for 1,816,067 units at 1½d. The largest and long users of electricity for private and business purposes got 3,253,625 units at 1d., producing £13,556. But this was only made possible by that heavy revenue of £50,498 at 7d. Public lighting is also charged 7d. and 1d.—the street-lamps getting 92,547 units at the former price, and 886,612 at 1d. Of course, Mr. Arthur Wright, the Consulting Engineer and author of this device for charging for electricity, is lamenting the apostasy of the Brighton Electricity Committee. It is calculated that the adoption of the flat-rate of charge will mean a certain sacrifice of £2800 a year, which the department, Mr. Wright says in effect, will be glad enough to have to meet the claims of capital. That there will be this amount of money put into the pockets of the consumers as a result of the change, seems to suggest that the maximum demand system does not operate altogether fairly.

In the early days of electric lighting, one point advanced in favour of this system of street illumination, which point the electricians considered had marvellous potency, was that it would do away with a number of traffic-impeding columns. Ever and anon, the same argument has been put forward; and it was raised as recently as the change from electric to gas lighting in certain of the City streets. Economy and efficiency might be bye-passed, was the reading of the argument, so long as fewness of lamp columns could be attained by the use of arc lights. Electric tramways—a convenient and expeditious means of locomotion—have become the fashion in many communities; and with it in numerous towns the streets have been made unsightly by almost countless columns of great height and girth, supporting a fearful-looking network of wires. In view of this, electricians, who are more concerned in the day-load of a tramway system than the intermittent custom of the public lamps, are, where the trolley-wire system exists, a little more careful as to what they say at the present time of the frequency of columns where gas-lamps are employed; for never was greater danger introduced into streets than these trolley-wire standards. On foggy and very dark nights, however well the streets are lighted, if the columns are painted a dark colour, one finds them, in driving, exceedingly dangerous, and if of a light colour on a fairly light night and with a good illumination from the street-lamps, they are then hardly distinguishable until one is close upon them. We are, of course, referring here to poles placed in the centre of the roadways, which are more dangerous but less ugly than those placed on the footpaths. In view of their well-recognized danger to drivers, every means must be taken to prevent accident; and therefore, in many towns, lights are placed on the columns, more as a warning than for the general illumination obtained. In view of this danger, we were astonished to read in the "Electrical Review" recently—

A Belfast correspondent has written us as follows, on the lighting of the city: "The electric tram system was inaugurated in Belfast *some three months ago*. Poles in the centre of the street are generally used; and as these are *practically invisible after sun-down*, oil lamps are attached to each pole. Street lighting is by means of gas—incandescent and flat-flame. Royal Avenue at night is probably without a parallel in Europe—incandescent gas down the side, twinkling oil-lamps down the centre; and this in one of the broadest thoroughfares Britain (U.K.) can boast of. Truly, a notable example of municipal enterprise, and a triumph for gas." Our correspondent's letter is a timely one; such triumphs are much appreciated by the gas journals, although not by the groping wayfarer.

There is a hidden electrical grievance here. The Police Committee have distinctly determined that they will not go in for the lighting of these thoroughfares from the centre poles; and therefore the real street lighting is done, and well done, by the incandescent gas-lamps on the footpaths. The question has arisen whether the Tramways Committee are bound to light the traffic-obstructing centre-poles; and reference has been made to the fact that in many English towns this is not supposed to be necessary. The Tramways Committee, however, have chosen to have them lighted for their own and the public protection; and arrangements have been made for the fixing of two incandescent electric lights on each pole in those thoroughfares in which the posts are in the centre of a street. Meanwhile, as a precautionary measure only, oil-lamps were placed at the base of each column. Surely the "triumph" belongs to electrical engineering.

PERSONAL.

Mr. Henry Hawkins, of Todmorden, has been appointed Gas Engineer to the Limerick Corporation, at a salary of £300 per annum. There were 63 applicants for the position.

We learn from Mr. Henry Rayner, the Secretary of the Gaslight and Coke Company, that at the meeting of the Court of Directors last Friday, Mr. James Douglas Walker, K.C., was appointed to fill the vacancy on the Board occasioned by the death last month of Sir William T. Makins, Bart.

OBITUARY.

The Late Mr. Samuel Stewart.

Regarding the notice of the death of Mr. Samuel Stewart, late of Greenock, which appeared in the "Journal" for the 13th ult., we are asked to state that our Edinburgh correspondent was in error in mentioning that "when he [Mr. Stewart] did retire, it is not to the credit of the Corporation that they delayed the fixing of a retiring allowance to him till about two years ago; and that, when they did at last dispose of the question, they voted an altogether inadequate sum, considering the services they had received." In point of fact, Mr. Stewart did not receive any retiring allowance whatever from the Greenock Corporation. A motion was made in the Council that he should receive £120 a year; but it was lost, upon a division.

It was also stated that "the ailment which laid him [Mr. Stewart] aside was an affection of the brain;" but such, we now learn, was not the case, as Mr. Stewart really died from the effects of nervous collapse which occurred some years ago.

Since the notice of Mr. Stewart's death was prepared, we have been informed that the funeral service was conducted in the deceased's residence, Broompark, Cove, Dumbartonshire, by the Rev. James A. Cameron, B.D., Minister of Kilcreggan United Free Church, and at the Greenock Churchyard by the Rev. Kenneth A. Macleay, B.D., Minister of Craigrownie Parish Church, Cove. The pall-bearers were: Messrs. C. Holroyd Paull (Glasgow), David Renton, Solicitor (Edinburgh), James Barr, C.E. (Glasgow), Thomas Hunter, C.A. (Glasgow), W. S. Brown (Giffnock), Daniel Macfie (Edinburgh), Joseph Hepworth (Edinburgh), and Dr. Alexander (Cove).

It is announced that Herr. C. Fexer, the Manager of the Municipal Gas-Works of Bamberg, died on the 6th ult.

At the meeting of the Harrogate Gas Company last Tuesday, the Chairman (Mr. S. Hornby) made feeling reference to the death, which had occurred on the previous day, of Mr. Charles Greenwood; and a vote of condolence with the relatives of the deceased was passed. Mr. Greenwood, who was intimately associated with the town, was a Director of the Gas Company, and a Freemason of long standing. On the Monday morning he appeared to be enjoying his customary good health; but about noon a fall was heard in his room, and he was subsequently found dead upon the floor. Deceased was 67 years of age.

Notice was issued on Saturday by the Private Bill Office of the House of Commons that the second reading of the Gas Companies (Removal of Sulphur Restrictions) Bill will be taken to-morrow (Wednesday).

An 1800-horse power gas-engine, operating a 1000-kilowatt generator, will form a part of the power plant of a plate-glass company at Pittsburg. The engine is of the four-cycle double-acting type. It is a horizontal four-cylinder engine, with a 42-inch stroke and a speed of 107 revolutions per minute. The unit is designed to use producer gas made from Illinois bituminous coal.

THE PLAISSETTY INVERTED MANTLE.

Uncollodionized Inverted Mantles for Consumers.

THE Plaissetty method of manufacturing mantles—to the improvement of which Mr. Thomas Terrell, K.C., has devoted much attention—is one which holds an unusual interest for the student of the manufacture of incandescent mantles, inasmuch as it withdraws itself from one of the very first principles of conventional mantle manufacture. It will be remembered that, in the Plaissetty system of manufacture, the illuminating salts were thoroughly incorporated with the artificial silk, before the mantle fabric was knitted, which is just the reverse of the usual form of procedure. The reasons which led Plaissetty to adopt this particular method of manufacture were fully explained is an article that was published in the "JOURNAL" on Oct. 28, 1902—in fact in that article the whole chemistry of the subject was entered into; and so there is no occasion to now cumber this notice of an inverted mantle made on a modification of Plaissetty's invention, by retracing the operations then described.

The Plaissetty Manufacturing Company (whose works are at No. 31, Dermody Road, Lewisham) have abandoned the use of the original Plaissetty method of manufacture, so far as it refers to the use of silk; for the reason, the Manager informs us, that the effect of collodionizing mantles burnt off on a silk fabric is that the mantles, after a short time, become fractured beyond use. The result has been that more mantles than we care to mention have had to be "scrapped" rather than allow them to go on to the market, and risk bringing the name of Plaissetty into ill-repute. However, before this grave difficulty was realized, Mr. Terrell had taken out a patent for assimilating the Plaissetty process for use upon a natural cellulose or cotton fabric; he having found that a mantle quite as good could be made by his system with cotton which would stand the collodionizing. One of the essential features of the process is that the organic fibre must be absolutely pure. Therefore, all the cotton has to be chemically cleaned before use. After this, the salts are incorporated in the fabric according to the process, an essential feature of which is that the impregnated material must be made to absorb salts in proportion to the weight of the cotton. The whole excellence of the mantle made on this system rests on the perfect combination of the oxides of thorium and cerium with the cotton, making a perfectly homogeneous structure of each filament—so much so that even experts confess to not being able, on microscopical examination, to distinguish the thorium from the cotton. Owing, however, to the exactitude that is necessary to produce the mantles, to make a cheaper class the process may be modified in certain particulars. A cheaper mantle means a lessening of the quantity of oxides, and to lessen the oxides a much finer cotton must be employed; and this, of course, produces a finer filament. The cotton that is used in the standard process gives a mantle weighing between 0·6 and 0·7 gramme for a "C" mantle, after the burning off.

By the above process, when the mantle is burnt off, all that takes place is that the cotton is destroyed—seeing that the thorium and cerium have not to be converted from nitrate to oxide. Now advantage has been taken of this fact, and of the one that the stocking, before being turned into a mantle, is very much less in bulk than the ordinary form of stocking—that is to say, that a given amount of stocking made in the ordinary manner would, before it was burnt off, have about four-and-half times the weight, and about two-and-a-half times the bulk—to make an inverted mantle which can be sold to the public in the stocking form, and which the public can burn off on their own inverted burners without high-pressure gas. It has long been held on the Continent, and by many in this country, that the collodionizing of mantles has an injurious effect on the mantles—both in their strength and their light-giving power; and now, for the maintenance system, we believe that one or two of the London Companies are doing their own burning off so as to get the benefits of an uncollodionized mantle. For Plaissetty mantles of the ordinary form, high-pressure gas is used in the burning off to get them of good shape; but in the case of inverted mantles, the Company are conclusively proving at their works that, by a process discovered by them—after the stocking has been knitted, one end sewn up, and the other end attached by ordinary means to the supporting ring—the mantle can be prepared so as to be sent out to the public for immediate use on ordinary inverted burners, without being first burnt off and collodionized.

There are, however, advantages; and there are disadvantages. We will refer to the latter first, and then let gas managers who are responsible for recommending mantles to their consumers try for themselves whether the advantages outbalance the disadvantages. The advantages that are claimed are most important ones, and ought not to be lightly dismissed. When a mantle is suspended from the burner, a flame is applied, and the combustible material is destroyed. The gas is then ignited; and, for an appreciable time, a flame—not a very great one—plays above the mantle. That is the first disadvantage, but the process and effects of the combustion are no worse than those associated with the burning off of the collodion on an ordinary mantle. The second is that the full illuminating power of the mantle is not developed for some little time after being put on to the burner. Discounting both these disadvantages is the fact that times of renewal, when the disadvantages arise, are infinitesimal compared with the periods of use between the renewals. Now as to the advantages. In the first place, there is a great difference between the shape of a mantle so burned off under normal pressure on the consumer's burner and an ordinary collodionized one. The former assumes the shape of the flame produced by the particular burner upon which it is to be used. An examination of the flames given by different makes of inverted burners, reveals a great difference between them. One standard shaped mantle will not fit these varying flames; the result being that the mantle will either have non-luminous patches where the incandescence is not perfect, or the mantle will adapt its form to the flame with the effect of weakening the structure. The makers contend that the advantages of each mantle fitting its own particular flame are enormous, ensuring as it does complete incandescence. When, after the first ignition, the mantle becomes thoroughly incandescent, there is for a time a visible improving tendency in the illuminating power, which then remains practically constant during its entire life. Photometric tests made at the works, on a bar photometer and with a 10-candle standard pentane lamp, give to the developed inverted mantle, used on a Darwin burner, illuminating powers approaching, and in some tests equalling, 20 candles per cubic foot of gas consumed at normal pressures—the variations in the gas pressure being sufficient to account for the differences in the illuminating power. The next advantage is that there is not the necessity for the careful packing for transport that is required in the case of ordinary collodionized mantles; in fact, these loose unshapened mantles can be sent about crushed without the slightest injury. Under this circumstance, there is no chance of spoiling in transit, of damage in handling, nor need the cost of separate cylindrical boxes be incurred for each mantle. These are the advantages—in addition to that of the greater strength and longer life claimed as resulting from the mantle never having been subjected to the weakening effects of collodion—of the uncollodionized inverted mantles; and gas managers may be depended upon to soon weigh the advantages and give them their proper value, by comparison, with ordinary collodionized mantles. The Plaissetty Company are satisfied that they have no need to fear the result.

A few words more. From an inspection of the manufacturing work now being prosecuted at Dermody Road, the great care that is taken in each particular operation in the developing stages is observed. Accuracy in length, in the making of the head, in the sorting, in the cutting, and so forth has been the subject of study. One very interesting feature in the works is a new high-pressure burning-off and hardening apparatus for producing the ordinary form of inverted mantle, which will deal with ten mantles at a time. In it, everything is under control; and perfectly shaped mantles are the result. At this time of day, it is unnecessary to go further into the processes involved in mantle making.

Standardization of Harcourt Pentane Lamps.

Notwithstanding the fact reported recently that Dr. R. T. Glazebrook, the Director of the National Physical Laboratory, does not recommend the 10-candle pentane lamp as a standard of light for use in electric lamp factories or testing-stations, there is a large demand for the lamp for such use as well as for testing the illuminating power of gas, for which purpose it was, of course, primarily designed. But difficulty appears to have been experienced in obtaining with the lamps (apart from the maker's guarantee) certificates that their construction and lighting-value are correct. The lamps supplied for use in the gas-testing places of the Metropolis and by the London Gas Companies have all been examined and certified as correct by the Metropolitan Gas Referees; but these officers have refused to examine lamps for use by the general public or in Provincial gas-testing places. Mr. W. J. Atkinson Butterfield, their Secretary, informs us, however, that the Referees have now agreed to give facilities for the comparison of any Harcourt 10-candle pentane lamps with the original standards (which are in their possession). They have granted him the use of these standards, and their working drawings and testing apparatus for the examination of lamps, in order that anyone who wishes to have a certificate of correctness may be in a position to obtain one signed by him. But as this work does not fall within the scope of their or his official duties, Mr. Butterfield will not sign the certificate as their representative, and will charge a fee for the examination. Lamps for examination may be sent to him at No. 66, Victoria Street, Westminster. Mr. Butterfield will examine all lamps that are so sent to him in the same manner as he has examined for the Gas Referees the lamps which they have certified for use in London since the standard was introduced in 1898.

The Vienna Correspondent of the "Pall Mall Gazette" says that an Austrian electrical engineer has invented a new incandescent lamp, which is reported to make electric light a cheaper illuminant than gas. Instead of charcoal, the new burner consists of metal wire which possesses a remarkable property. After being in use from 1000 to 3000 hours, the wires are burned through, but by a self-acting process they are soldered together, and continue to burn. This new lamp, it is said, requires only such a very weak electrical current that it costs less than gas.

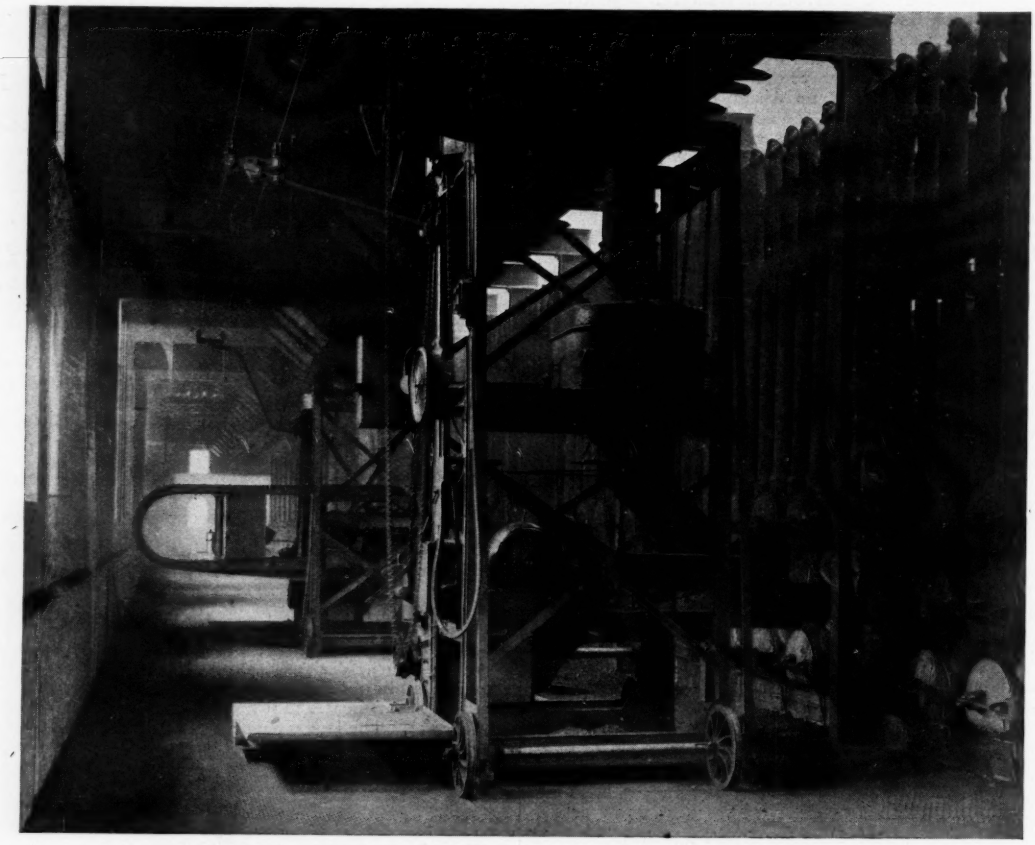
WEST'S ROTARY PROJECTOR AND RAM-DISCHARGING MACHINE AT BRISTOL.

THE Bristol Gas Company, on the recommendation of their Engineer, Mr. D. Irving, have introduced West's patent stoking machinery of the projector and ram-discharging type into their carbonizing operations. This is the form of retort-house machinery which was described in the "JOURNAL" (from the patent specification) for May 2 last year; and this is the first practical application in England. The installation consists of one charging machine and one discharging machine—both electrically driven.

The retort-house in which the new machines are found is at the Company's Stapleton Road station. The house is a ground-floor one, built in 1880, of Penant stone with red-brick facings. It has recently been reconstructed, and fitted complete with stage-floors and admirably designed coal and coke handling plant—all likewise electrically driven.

The new stoking machines are now working on the north side of the house, which contains 24 settings of nine retorts, having one producer for each setting, situated on the opposite side of the bench to the machines, and adapted so that the coke from the centre retorts falls directly into the producer as it is pushed forward through the retorts by the discharging machine. On the same side, and above the machines, are fixed the coal-storage hoppers, which extend throughout the whole length of the retort-house, and from which the charging machine is supplied with coal through outlets directly over the vertical centre line of the retorts.

As the season was well advanced before the house was completed ready for gas making, it was found necessary that twelve settings should be placed on full work as soon as possible; and upon this number of settings the machines commenced operations on Nov. 15 of last year. Although this was rather severe work for new machines to start upon, and three separate gangs of



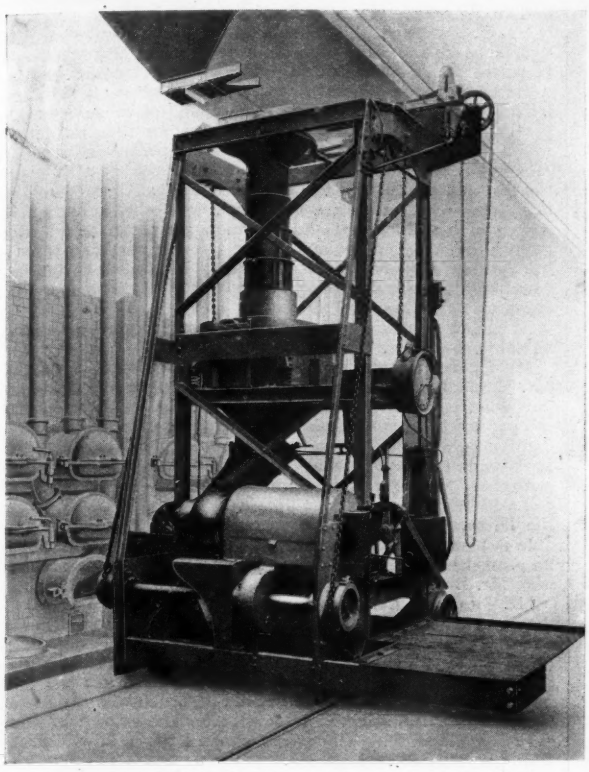
View in the Retort-House at the Stapleton Road Gas-Works, Bristol, showing West's Rotary Projector and Ram-Discharging Machine.

stokers had to be instructed in their use, it is a pleasure to state that, nevertheless, the task was accomplished in a most satisfactory manner; and the machines have been in constant and regular work since that date. More important still is it to state that to-day they are successfully charging and discharging eighteen settings or 162 through retorts at the rate of one retort per minute; the weight of the charge to be carbonized being 7 cwt. per retort.

Many novel and interesting features have been introduced into these machines; and one is struck with their simplicity, and the ease with which they are handled. So much is this the case that, within a very short period, the stokers were fully master of the various operations required to charge and discharge the retorts in a most efficient and quick manner.

In the operation of charging, the machine is placed opposite the open retort at the required level; the motor for rotating the charging-drum is then set in motion (at its slowest speed) by the main switch, after which it requires no further attention from the operator, as the varying speed required in charging the 20 feet long retort is attained automatically. The operator then opens the overhead coal-hopper door by means of a patented device fixed to the machine, to allow a desired quantity of coal to fall into the small hopper suspended in the machine. This arrangement of gear is operated by means of a chain from the platform of the machine, and engages with a lug on the underside of the coal-hopper door. Thus the operator is not required to step off the machine in order to obtain a supply of coal; and the range of levers along the retort-house usually found in connection with overhead storage hoppers, is in this retort-house entirely dispensed with, as is shown in the excellent photograph which we reproduce. In order, too, to show the details of the machines more clearly, separate views of the machines are given.

Directly in front, and in full view of the operator, is a large dial, which indicates the weight of coal that is being deposited in the hopper of the machine, so that any desired weight of charge may be obtained for any retort at any time. This is an important and distinct feature of the machine. Besides weighing the coal, this hopper—attached to which is some specially arranged gearing, connected to the controlling rheostat of the motor—performs, by the weight of coal that is actually in the hopper, the automatic regulation of the speed of the charging-drum to that required to distribute the coal evenly in the retorts from end to end of their length. Positive regularity of charge is thus ensured, and any judgment on the part of the operator is entirely dispensed with—the duty of the operator being simply to open the door in the bottom of the small hopper on the machine, and



West's Rotary Projector.

allow the coal to fall down a shoot, directly to the underside of the rotating charging drum, which projects the coal into the retort. The speed of the drum is, as mentioned already, automatically reduced, by means of the regulating gear, in proportion to the reducing weight in the hopper during the charge; so that, after the hopper door has been opened, all further operations are automatic, and no attention is required on the part of the operator to complete the charge.

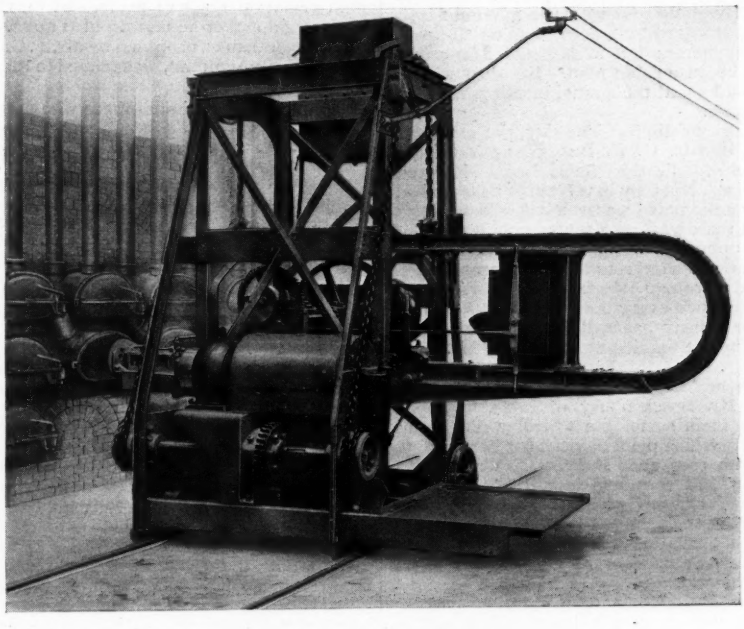
Before the coal leaves the machine, it passes through an expanding mouthpiece, again operated by the hopper according to the weight of the charge, which has the effect of producing a very level layer of coal across the section of the retort from end to end of its length—thus depositing the coal in a splendid manner for carbonization.

The time taken to charge a retort is, according to its size, from 16 to 30 seconds—dust to 3½-inch cubes; the results which are being obtained by the machine being most satisfactory to all who have been concerned in its installation and working.

The discharger is equally efficient in its operation. It is a telescopic ram, with a jointed flexible inner bar, by which means the ram telescopes are pushed into the retort to discharge the coke either into the producers on the other side of the house, or on to a conveyor for transport to the coke yard. The jointed bar is kept rigid by the telescopes when extending; and, on returning, it coils round and back over the top of machine—being driven by means of a sprocket wheel, engaging with it and connected by gear to the reversible electric motor.

Both the machines collect their supply of electric current, at 220 volts, from overhead wires fixed to the underside of the hopper-supporting girders in the house; the current being generated by gas-driven engines. The power house, which is an elegant and substantial structure, is built to correspond with the adjoining building, and is situated at the west-end of the retort-house.

As previously mentioned, this is the first practical application of these machines in England; but similar machines have been sent to the United States—the first having been installed at the Worcester (Mass.) Gas-Works. The plant there has been in operation for over eight months.



West's Ram-Discharging Machine.

The gas-turbine problem cannot be solved until satisfactory information is obtained on four points, according to statements made by Mr. R. M. Neilson before the Institution of Engineers and Shipbuilders of Scotland. These points are: (1) The losses in pneumatic compression to high pressures with reciprocating and rotary compressors or a combination of the two; (2) the expansion of hot gases in divergent nozzles; (3) the transference of heat from gases to metals at high temperatures, and particularly at very high velocities; (4) the oxidation of turbine blades when exposed to the action of air, steam, carbon dioxide, and other gases at high temperatures. Until thorough experiments have made on these four lines, he said, the chances of success of the gas-turbine will be very much shrouded in darkness.

In a report issued recently by the Labour Department of the Board of Trade, it is stated that between 1901 and 1904 the membership of Trade Unions declined by no fewer than 74,119. The number of separate workmen's Trade Unions known to the Labour Department as existing at the end of 1904 was 1148, with a total membership of 1,866,755. "In the three years of declining employment, 1902-4," says the report, "there was, as in previous periods of depression, a falling off in the membership of many Trade Unions. The total decline is from 1,940,874 members registered on the books of the Unions at the end of 1901, when the numbers were the highest recorded, to 1,866,755, at the end of 1904. This represents a fall of 74,119, or no less than 3·8 per cent."

SOCIETY OF BRITISH GAS INDUSTRIES.

The Election of Committees and Council—Mr. C. E. Brackenbury on Contracts and Specifications.

A successful meeting of the Society was held last Tuesday at the Holborn Restaurant. The first part of the proceedings was devoted to a private discussion by the members of administrative matters, including the election of the Committees of the various sections. The suggestion that was previously made, that the appointment of the Council should be deferred until the meeting in the summer did not find acceptance. As a matter of fact, according to the accepted rules, the meeting last week was the annual one, at which the Council were bound to be elected; and therefore the members determined that the most sensible course to pursue would be for the Chairmen of the Sectional Committees to constitute the Central Council. As the Chairmen of Committees will be elected annually, the Council will not become sterile through long continuance in office. The first Council consists of—

Messrs.—	Messrs —
W. P. Gibbons.	John Mackay.
T. S. Clapham.	J. W. Wilson.
F. J. West.	Thos. G. Marsh.
J. W. Broadhead.	J. E. Williams.

Mr. Charles Clare, *Honorary Secretary.* } *Ex-officio Members of*
„ John G. Glover, *Honorary Treasurer.* } *Central Council.*

Mr. W. P. Gibbons represents Section I. (Retort-Settings).
Mr. T. S. Clapham, Section II. (Exhausters, Purifying Plant, Residuals Plant, Retort Mountings, and Condensers).
Mr. F. J. West, Section III. (Conveying Plant and Labour-Saving Machinery).
Mr. J. W. Broadhead, Section IV. (Gasholders).
Mr. John Mackay, Section V. (Meters).
Mr. J. W. Wilson, Section VI. (Gas-Stoves).
Mr. Thos. G. Marsh, Section VII. (Gas-Fittings, Lighting Burners, Governors, and Scientific Apparatus).
Mr. J. E. Williams, Section VIII. (Manufacturers and Contractors not included in the Foregoing Sections).

The Council will at once proceed to consider the question of the election of a President. The gentleman invited, it is understood, will be one not immediately connected with the gas industry's commercial world, but whose interests in some way touch upon, or have their being in, commerce; but it does not follow that the President will always be an outside man. His duty will be to preside and deliver an address at the annual meeting, and take the chair at the annual dinner.

After the general business meeting on Tuesday, the members were treated to a paper by Mr. C. E. Brackenbury (of the Middle Temple), Assoc.M.Inst.C.E., on "Some Legal Notes on Contracts and Specifications." Not only in respect of its technical character, but in its opening the paper was well conceived for this first general meeting; and there was not a sentence in it that did not in some way or other appeal to the members of the Society. It was, in short, a most successful effort; and so it was pronounced on all hands. It is printed *in extenso* elsewhere in this issue, and will be found to have claims upon every one in a professional or managerial position in the industry, as well as upon contractors and manufacturers. During the reading of the paper, Mr. John G. Glover was in the chair.

The Chairman said he would leave Mr. Clare to introduce to the members their friend Mr. Brackenbury, who was, he hoped and believed, going to give them something which would be instructive—not from a purely selfish point of view, but in regard to straightforward honesty with respect to contracts. There was a lot to be learnt in connection with contracts; and it did not matter in which section they individually worked in the gas industry, the question of contracts between one man and another, and between company and company, was a very important thing. He thought that a contractor should have an opportunity of giving his views on a contract, because when all the power of framing a contract was on one side only, then it appeared to him to break down those very principles that should be at the foundation of, and should be carried through, everything that was of the nature of a contract between two parties. In strict honesty between man and man, between company and company, and in honesty in contract, all would find benefit.

Mr. Charles Clare said it was with the greatest pleasure that he introduced Mr. Brackenbury to the members. He thought they were very fortunate in getting such a gentleman to give them the first paper before their Society, because it would be difficult to find many men with the special qualifications that Mr. Brackenbury had for dealing with the subject from the point of view of the gas industry as a whole. He was accustomed to the views of the gas industry from the contractors' point of view, also from the gas engineer's, and now from the legal standpoint. He served his apprenticeship with a firm of contractors, he was an associate member of the Institution of Civil Engineers, a member of the Institution of Gas Engineers, and of various foreign Societies. He was also the author of two books—"British Progress in Gas-Works' Plant and Machinery," and "Modern Methods of Saving Labour in Gas-Works." Copies of these books Mr. Brackenbury had kindly presented to the Society.

Mr. Brackenbury, before reading his paper, said he hardly felt that he needed any introduction even to a new Society like this, because, for a considerable number of years, he had been connected with the members in one way or the other; and therefore he felt more at home among them than might have been expected. He thanked Mr. Clare, however, for the kind terms in which he had made what introduction was considered necessary. His only regret was that Mr. Clare had referred to a little gift to the Secretary. He had made this feeling that there should be a beginning, even at this early stage, with the formation of a library of a commercial and technical character, which library might grow with the Society, and be a source of considerable usefulness and a centre of information to both present and future members. [Mr. Brackenbury then read his paper, which is printed *in extenso* on pp. 644-47.]

At the close of the paper the Chairman commented upon its valuable character.

Mr. Fred J. West proposed a very hearty vote of thanks to Mr. Brackenbury, remarking that he thought the author was particularly happy in his opening remarks. It was extremely interesting to hear of their Society from the point of view of a gentleman who had been a gas engineer; and Mr. Brackenbury, he hoped, looked at the matter from a point of view that was shared by every gas engineer in the country. Speaking for himself (Mr. West), he had been greatly interested in the paper; and the information that had been given would be extremely valuable not only in the present, but in the future. In conclusion, he remarked that he was sure the members one and all would wish Mr. Brackenbury every success in his legal career.

Mr. Thomas Clapham, in seconding, said the paper to which they had listened had been an ideal one for the commencement of the Society. The Provisional Committee, in the organization of the Society, had had only one idea, and that the honest desire for the formation of a Society representing the gas contractors and manufacturers who could come into touch with the gas engineer for mutual objects, and to work for the growth of the gas industry generally. The paper showed them how difficulties were perpetuated by isolation.

The motion was heartily agreed to.

Mr. Brackenbury, in his reply, said that if, in his remarks, he had been able to throw any light upon points that were constantly cropping up in connection with contracts, he was sufficiently rewarded. He thanked Mr. West and other gentlemen for the kind remarks they had made, and for their good wishes to him in the legal career he had decided upon.

A vote of thanks, proposed by Mr. T. G. Marsh, and seconded by Mr. J. W. Broadhead, was passed to the Chairman for presiding.

[For the information of those who may desire to communicate with the Society, the name and address of the Secretary is: Mr. Arthur L. Griffith, No. 46, Queen Victoria Street, London, E.C.]

AFTER FIFTY-FIVE YEARS' SERVICE.

Retirement of Mr. John Surman, Chief of the Stores Department of the South Metropolitan Gas Company.

Hale, hearty, rotund, alert, and clear of memory, the writer found the object of his visit to the Old Kent Road Gas-Works of the South Metropolitan Gas Company last Thursday. His face was pleasant to look upon, his hand-shake cordial, and the spirit of youth seemed to have taken up a perennial abode in him. Such was Mr. John Surman on Thursday; and that day—how memories must have crowded upon him—was the fifty-fifth anniversary of his service at the Old Kent Road works. Retort-houses, plant, and gasholders have passed away, and new have taken their place, but John Surman, one and the same, has continued—only that the passing years have made those visible and natural changes to which all humanity is subject. But Time has dealt kindly and gently with him, though he has risen in position, and responsibilities have, with elevation and the growth of business, become greater and more onerous. Thursday found Mr. Surman "clearing up," as he put it; for on Saturday he signed the last paper, closed the last book, and left the Old Kent Road works for the last time as an official of the Company, though to the Company he will still be united, through that happy dispensation that has made provision for comfort and independence of "old age." The writer feels that an apology is almost due for the use of those last words in this particular instance; but when the service of fifty-five years is remembered, and that the boy John was over fourteen when he commenced to serve Mr. Thomas Livesey, father of Sir George, as office boy, one will be forgiven for calculating that the subject of this narrative is somewhere in the region of three score years and ten. He was, as a matter of fact—and he refers to it with a joviality that makes one believe that to him it is one of the most acceptable facts of his existence—born in 1836, the day after there had been a disastrous explosion in the purifying-house at the Old Kent Road works; and, excepting Sir George, he has been for some years the oldest living servant of the Company. And neither the one nor the other has a compeer in this respect nearer, in the case of the Chairman,

than (except Mr. Surman), seventeen or eighteen years, and, in the case of Mr. Surman, than fourteen or fifteen years.

Such a life of service in the South Metropolitan Gas Company is an historical volume of the changes in, and progress of, that now mammoth concern (and for the matter of that of the whole industry too), covering more than half a century. It is a long past that such a life in the industry connects with the present. But when one talks of these things to a man of the stamp of Mr. Surman, who has lived and seen the great changes come with, as it were, a day-by-day imperceptibility, he speaks of them almost as though they were merely the most ordinary happenings of progress. In other words, the remarkable character which the changes bear to those among us who have not lived in them over such an extended course of years, and who are impressed by the comparative volumes of the past and the present, do not seem so extraordinary to one who lived and worked in the days of relatively small business, and has seen the gradual accumulations to the original that make up the vastness of to-day.

As has been said, Mr. Surman had passed his fourteenth birthday when he opened what was to be the long chapter of his connection with the South Metropolitan Company, which was a far different South Metropolitan Company from what it has become since the amalgamations with the other Southern London Companies, and since the advent of the prepayment meter system, cooking-stoves and gas-fires, and the incandescent burner. It was in the humble but useful capacity of office boy to Mr. Thomas Livesey that the young John of 55 years ago started his work. Therefore Mr. Surman's service braces together the work of no less than four of the Company's Chief Engineers—that of Mr. Thomas Livesey, Sir George and (the late) Mr. Frank Livesey, and Mr. Charles Carpenter. Of Mr. Thomas Livesey, Mr. Surman wrote in the "Co-partnership Journal" only some six months ago, "No man ever served under a kinder or more considerate chief." The recollection is an abiding one. From what was written then, some of the immediately following information is culled. In those days, things were different from now. Instead of the large, business-like premises that serve as the offices in the Old Kent Road, but are even now—owing to the great and necessary growth of the staff to cope with the business—becoming too small, the office building of fifty-five years ago was a long, two-storied plain edifice, where the clock tower at the entrance near the Canal Bridge now stands (well known to the professional men of the industry who have visited Old Kent Road); the upper floor being divided into the Board-Room, the Secretary and Manager's sanctum, and the clerks' room. The ground-floor was devoted to the stores, stoves, and coke offices. The indoor staff then only consisted of the Secretary and Manager (Mr. T. Livesey), his son, two clerks, a coke clerk, and a storekeeper. The outside staff comprised two collectors, an inspector, and a canvasser. When one looks into the numbers of officials and their staffs—indoor and outdoor—now, the staff of 55 years ago has a somewhat liliputian aspect. But thus it was, in fact, in the days when young Surman passed some three or four years in intimate contact with his first master—first as office boy, and then as confidential messenger. Simultaneously, he made himself generally useful in other departments, especially in the meter-shop, where he became quite proficient in the construction, working, and testing of gas-meters. A vacancy occurring, Mr. Surman was transferred to the outdoor staff, as sub-inspector and index reader. But even then, in those days, he was able to devote a large part of his time to useful work in the office. The rapid transitions from the humble staff posts to the higher ones, was the reward of industry. Two years from the change recorded above, saw Mr. Surman in the position of clerk in charge of the coke office. This was a considerable promotion for him in those days.

Only a further two or three years passed, and then another change. The storekeeper of the day obtained permission to exchange offices with one of the collectors; and the latter gentleman, being somewhat advanced in years, found some difficulty in accommodating himself to indoor work and routine of which he had had no previous experience. The result was that much of Mr. Surman's time was given to the stores; and this commenced that career in connection with this swiftly growing business in which the subject of this sketch has shown such remarkable aptitude and eminent fitness. Ten years from the opening of his work as office boy to Mr. Thomas Livesey, he was advanced to the position of storekeeper. Business increased, and the Company made great progress. This is what Mr. Surman himself has written in the "Co-partnership Journal" of the great happenings within the next score years—

In 1861, the offices being quite inadequate to our need, the Company removed to the then new and enlarged ones at Canal Bridge. At this time the Company was not the only one in South London. They had two neighbours and rivals in the Surrey Consumers' and the Phœnix—the former having its headquarters in Rotherhithe; the latter, and by far the more powerful, having three stations in our near neighbourhood (Vauxhall, Bankside, and Greenwich). But in 1879, under Sir George Livesey's administration, the Company absorbed the former, and amalgamated with the latter the following year. Thus from quite a small Company has the South Metropolitan attained to its present dimensions. These changes compelled the Company to again rebuild on their present site. The various "stores" of the different establishments were merged into one Central Office; and I was appointed Chief Storekeeper and Head of the Department. I may here remark that Sir George's father, Mr. Livesey, died suddenly a few years prior to these great changes. He had, however, undoubtedly conceived them, and would certainly have effected them but for his untimely decease. He died universally and deeply regretted by none more than myself, to whom he had always been the kindest of patrons and friends.

Few there are who know what a busy place is the "Stores Department" of a Gas Company like this. The two words cover a multitude of operation of dissimilar character. Such a department seems to be really a "dumping-ground" for almost everything; and a general registry for the Company's purchases of materials (other than coal) and goods and appliances, a place in which numerous accounts are vouched, in which the entrances and exits of goods and appliances for the district and consumers' use are recorded, and in which the history of incandescent, stove, meter, and all sorts of other work and business is kept. Then there is a general supervision of the details of such financial things as wages, club funds, and co-partnership. Mentioning wages, Mr. Surman says that, when he entered the service, the wages for a week were £136 1s. 4d.; while last year the weekly average was over £10,000. When he started, the Company boasted only 120 workmen; now the number employed at the stations and on the district is about 5500. This is one illustration of the great employment the gas industry has provided for the country's workers during the past half century. A reference to lamplighters led Mr. Surman on to point to the great increase that has been made during his time in the average wages of gas workers. When he was a boy, for instance, the lamplighters used to get 16s. 10d. a week—the odd 10d. being for ladder, oil, and cleaning leathers. Now, the average wage is 27s. 6d., and more for the foremen. Connected with the central stores department are also the branch stores; and five motor vans are now engaged in delivering goods about the district. This various information gives some indication of what an important institution the "Stores Department" is in connection with such a huge concern. It is a centre into which from the Board Room, through the departments of the higher officers, several channels find inlet; and from the centre again there are numerous outlets. It requires a clear and steady head, and a firm hand to be the chief of such a department. For the responsibility is great and far-reaching, as this sketch—which admittedly indifferently portrays the actual thing—has shown.

Asked what he considers were the most important events in his long connection with the Company, Mr. Surman does not take long to ruminate. "Domestically," in their chronological order, "the amalgamations, the strike, and the co-partnership scheme;" and his references to the matter include a glowing account of Sir George Livesey's courageous generalship in bringing to an issue causes in which he sincerely believed—and which belief has been confirmed by the results—that he was working for the right. From the business standpoint, the greatest occurrences have been, in Mr. Surman's view, the introduction of the incandescent mantle, the slot meter, and cooking-stoves. The almost "mad" rush with which, when the wholesale change was made from flat-flame burners to incandescent ones in the street-lamps, the work came upon his department, and similarly when the introduction of the prepayment meter received an almost immediate popularity, is now regarded by him with an equanimity that is the antithesis of what he felt, as the responsible head of his department, at the time the rush was on. The first prepayment meter went out in 1892; to-day their total in the Company's area is 190,640, as compared with 112,000 ordinary meters. In June, 1872, the first gas cooker was sent out by the Company, and at the end of that month the records show us that that stove represented the "1" that stood against the words "net increase." Turning over the carefully kept monthly records of the 34 years that have rolled by, it is seen that, in the corresponding month of June last year, the number of cookers sent out was 5079; the number brought in for cleaning, repair, through removals, and so forth, was 3101. So that there was a net gain on that month of 1978—the total number out at the end of January last being 215,540, independent of gas-fires and other heating appliances and gas-engines. These are illustrative figures of the responsibility that has crowded, in only two directions, upon the Stores Department, and example of the remarkable change that has come over the scene in this one life's business work.

But the long chapter of loyal, honest, painstaking service is now closed, and Mr. Surman goes to enjoy his well-earned leisure and rest. With him, he takes the good wishes of all connected with the Company—from the Chairman himself down to the worker in the lowest place in the ranks. To the Chairman, he has always been known as "John;" for it was 65 years ago that their friendship was struck, when "rounders" and climbing trees in a field adjoining the works had a greater fascination than the important question of the gas supply of London. "John's" cheery face will be much missed at the works. For in his time he has seen boys grow to men in the service; he has seen successions in the service unto the second and third generations of the same families. They all knew him; and he has grown into (so to speak) a living part of their working lives. But the link has been snapped. His official place will know him no more. He carries away with him heartfelt wishes for the future; he leaves behind him many regrets at his departure. Next to the Chairman, Directors, and chief officials of the Company, no man was known better, through the position he occupied, to a large section of the gas industry who had business relations with the Company; and from no man's lips has anything but good been heard by the writer of John Surman. May his rest be long and filled with happiness, to crown a life of service discharged with the fidelity that springs perpetually from a nature in which moral duty is so strongly implanted.

SOME NOTES ON GAS-FIRES, FROM A CONSUMER'S STANDPOINT.

By F. H. Leeds, F.I.C.

For the purposes of the present article, gas-consuming apparatus intended for the warming of apartments may be loosely divided into three classes—(1) the so-called condensing-stove, (2) the apparatus with concealed luminous flames and a metallic reflector, and (3) the gas "fire" with atmospheric flames playing upon some appropriate refractory material. Both of the latter are, or should be, connected with a flue for the escape of all combustion-products. Only stoves of the last variety are referred to in the following lines—partly because the writer prefers them, and has most experience with them, and partly because at the present time they are probably most popular. Technically or economically, there is no doubt that the gas-fire ranks below the condensing-stove, and perhaps it is also less efficient as a means of utilizing the latent heat of gas than the reflecting-stove; but in a matter of the present kind strict efficiency must be relegated to a position of second-rate importance whenever, or if ever, it comes into conflict with hygienic value or comfort. For various reasons which it were futile to enter upon here, the open coal-fire is still to be found in the dwelling-rooms of the average private house; gas warming-appliances being employed in bedrooms and sitting-rooms which are only occasionally occupied. Inasmuch as the gas-fire is used, or tends to offer itself for use, mainly in the bedroom, it brings itself very largely under the notice of the invalid and the doctor; and its behaviour has to be judged more strictly as a hygienic piece of heating apparatus than the coal-fire in the dwelling-room. The occupants of the dwelling-room undergo daily exposure to the open air, and their state of health renders them comparatively immune to defects in the heating apparatus; but the invalid frequently lives months at a time in a gas-warmed atmosphere, and feels very acutely (objectively, if not subjectively) small vitiations in the air.

The foregoing explanation is offered as a reason why the gas-fire is now being studied from a somewhat specialized aspect, as part of the contents of the invalid's chamber. There is nothing unfair in this. The combustion products of a well-designed gas-fire may be hygienically regarded as consisting of highly-diluted sulphurous oxide, which it is harmful even to the most robust person to inspire. A quite considerable proportion of the middle-aged belonging to the middle classes of society, who are the chief consumers of gas, when their health is indifferent during the winter months, suffer from affections of the bronchial organs of a bronchitic or asthmatic kind; and it is perhaps not commonly known that the breathing apparatus of this variety of semi-invalid, more especially the asthmatic, forms as keen a qualitative test for the presence of sulphurous oxide as any reagent the chemist can apply. Hence the gas-fire can only be regarded as satisfactory if it passes the involuntary tests of the man who suffers from asthma; and if, by reason of improper construction or erection, it fails to pass, the fire must be condemned as really unfit for use even by persons enjoying perfect health.

It is a well-known fact that many physicians still look with unfavourable eyes upon a gas-fire of any kind—a few notable authorities to the contrary notwithstanding. There are several causes for this. Doctors are very human; and when their patients suffering from diseases of the respiratory system do not respond as quickly to the treatment given as the physician expects, he looks around for a scapegoat. Having read unfavourable reports of gas firing, where due differentiation between the various systems has not been made, or having had unfavourable experience in his own practice without the leisure to investigate the true cause, the physician offers up the gas-fire as a sacrifice; and (it may be) the patient incontinently improves—the disease having by that time run its course. A case of this kind came under the writer's personal observation not long ago. A patient, liable to asthma, was recovering from a mild attack of pneumonia with a slowness disrespectful to the family doctor. He was in one of those small, low-pitched rooms that abound in suburban houses, which contain in one wall an iron receptacle for fuel bearing the same proportion in size to a proper coal-grate as an opium pipe does to one used for tobacco. An incandescent gas-fire stood in front, running night and day. The patient had had no asthma. One day the doctor peremptorily ordered the substitution of a coal-fire for the gas. In twenty-four hours, the increase of dust in the room set up a violent spasm of asthma, complicated by want of sleep through the almost uninterrupted stoking of the tiny coal-fire by the nurse. In two days the gas-fire was replaced; and, incidentally, an important convert to the hygienic superiority of gas-firing, when properly managed, was obtained.

Physicians are not likely to be prejudiced against gas firing except as a result of unhappy experience or incorrect information. But there is another skilled class of the community who should be most distinctly prejudiced in its favour. Properly trained nurses who have taken up private practice are somewhat opinionated women, but they are highly intelligent; and the work they have to do is almost halved when there is a gas-fire in the patient's room. Yet in the writer's experience (and it has been unusually wide), most of such nurses with whom he has come into family or personal professional contact have entered his house inimical to gas firing, and have quitted it converted—not from laziness. Thus the question arises, Why, although gas firing has undoubtedly made rapid strides of late years, is its progress still so slow, and why are so many doctors and hospital-trained nurses opposed to it? Gas companies and the makers of fires are constantly bringing such apparatus before the notice of the public; so that general ignorance cannot be pleaded as the cause. The real reason is that a very large proportion of the experiments made by the public in this direction have proved distinct failures; frequently because badly designed or constructed apparatus has been installed, but more often because the installation has been carried out in an improper fashion.

The latter accusation may be studied first. In nearly all cases when a good gas-fire has been unsatisfactory in use, the fault lies in the arrangements made for the removal of the combustion products. Sometimes a self-satisfied fitter will knock a hole in a side wall of the house, connect up the fire through two elbows to about 6 feet of vertical pipe outside, erect a cap on the top, and forget that there will be a downward current every time the wind beats against the wall. But, apart from this idiotcy, a gas-fire is handicapped in all houses in which the brick chimneys have been built according to modern enactments to suit coal-firing, because the transverse area of the chimney is too large. Six or more feet of sheet-iron piping run up inside the chimney helps the draught to some extent—possibly by a kind of injector action; but still, unless one or more of the contiguous chimneys are heated by other warming apparatus, the brick walls near the top of a tall house are not sufficiently raised in temperature by the gas combustion products to keep the products from cooling. Hence the upward current is checked; the cool but foul air in the upper part descends again at the edges of the chimney, and sometimes enters the room when it is tightly closed against the air elsewhere. An obvious cure for this would be to lead the iron flue right through the chimney till it projects above the "pot;" but the proper remedy is a provision of inlet ventilation. The necessity for positive inlet ventilation in the houses of the middle-class—coal firing or gas firing—is almost wholly ignored; dependence being placed (when the matter receives any thought at all) on the porosity of the walls and the floors, and on the cheap carpentering of the window frames.

From the day, thirty to fifty years ago, when houses were built as solid self-contained blocks, to the time when the modern flat was introduced into this country, suburban residences were constructed with "additions." This addition at the back contains a different number of storeys from those in the house proper; and therefore the chimneys of rooms on approximately the same floor are of very different heights. Thus when all the windows are closed, and a fire is alight in a room with the taller chimney, if the interior doors are open, air to supply the fire is drawn down the shorter chimney of an unwarmed room usually on the same floor; while if the fire in question is powerful—much more powerful than the fire in the room where the shorter chimney is—air will be similarly drawn down, accompanied by combustion products, even when a smaller fire is alight in the second room. This can be demonstrated in the popular manner best understood by the non-technical householder, by showing him how his brass ornaments near the weaker fire become tarnished by the "sulphur." Of course, all this applies to coal firing equally with gas firing. In the former case, however, the descending air is laden with the odour of "soot," which is so intolerable that measures are at once taken to stop the nuisance. When only gas-fires have been used, the chimneys are clean inside; and as the combustion-products of a good gas-fire when fully alight are sensibly odourless—at least, to the untrained and not particularly sensitive olfactory organs of middle-aged and elderly non-chemical persons—there is nothing to show (except the tarnishing of brass) that the down-current exists. The trouble is accentuated in populous neighbourhoods, where the houses are built with additions, by the number and irregularities of adjacent steeply-sloping roofs, which assist in determining an actual down-draught in some chimneys when the wind lies in a certain direction, even when no assistance is being given by the syphoning action of other taller chimneys.

This defect in houses with additions is not to be cured by building all the chimneys of the same altitude; because, apart from prohibitory reasons of an æsthetic and constructional character, a chimney projecting so far above the roof of a low addition as would bring it to the same height as the chimney in the house itself, would be exposed to so much cooling action in its upper portion as to be practically useless. Neither is the trouble to be cured by having some of the windows constantly open, so that fresh air may be drawn in without friction. In busy neighbourhoods, such as London suburbs, windows cannot be kept open constantly—the dirt and the local noises prevent it. The cure is the application of an intelligent system of inlet ventilators. When a good gas-fire is installed in the manner (somewhat extravagant, but hygienically superior) the writer prefers—viz., some few inches clear of the coal-grate front, and without a plate round the elbow where it enters the chimney, or with a silent mica-flap outlet ventilator in its own brick chimney at the top of the room (the plate round the elbow being then used) the burning gas-fire will ventilate the room as efficiently as any coal-fire, always provided that an equivalent quantity of fresh air is absolutely unhindered

from entering the apartment. A powerful gas-fire set back tightly against the chimney breast, with a well-fitting plate round its outlet, and with no outlet ventilator near the ceiling, does not ventilate a room as well as a coal-fire, and on occasion it may "smell" through the collection of dirt (dust of an organic nature) on inconspicuous portions of its hot surface. It seems impossible to teach ordinary people that the more the natural inlets of a room are blocked, the more "draughty" does the room become in the human sense of the word. Air must enter in sufficient quantity to supply the fire, &c.; and if the number of inlets is limited, the speed of entry increases. It is speed, not volume, in a current of cold air which we term draught. A draught is often to be cured by making another.

Owing to the limitations mentioned at the commencement of this article, there is little more to be said about the defects of gas firing from a consumer's standpoint when hygiene is put in the foreground; because, as a class, incandescent gas-fires are good, and fail primarily because they have been erected unsuitably. Nevertheless, results not wholly satisfactory are sometimes obtained with gas firing of this kind, even when the outlets for the combustion products are quite trustworthy. With the idea of achieving greater economy, fires too powerful for a room are sometimes adopted, especially such apparatus as comprise downward and lateral passages within their body for the better utilization of the heat before it escapes from the apartment. This system naturally increases the superficial area of hot, but not incandescent, material within the room, and hence tends to increase the proportion of heating effect due to convection as compared with that due to direct radiation; and the former, as is well known, should be kept as small as the pockets of the fire-user will allow. But over and above this, an excessive area of moderately hot surface in a gas-fire makes for a slight odour in an imperfectly ventilated apartment, for a reason which is not altogether clear. It presumably depends, however, at least to a large extent, on a slow incineration of organic dust on the hot metal; the dust being partly microscopic fibres of woollen material, and partly dead epidermis from ourselves, mixed with some road dirt entering through open windows or introduced on outdoor clothing, all of which becomes entangled with that mysterious substance known as "flue," and settles everywhere.

This reference to dirt and flue leads directly to the chief complaint that can be brought against many gas-fires of the incandescent variety—viz., their inaccessibity for cleaning purposes. The gas-jets of an ordinary fire lie very near the floor, and thus inject into the mixing-tube a large proportion of the flue and dust formed in the room. In time this material carbonizes or partly burns in the tube, reducing its effective area. After a few months' continuous running, the tube becomes irregularly blocked; and the consequence in fires where all the burners are fed from the same original gas-jet or collection of jets, is that the flames are higher on one side than the other. When the fire is turned down to a point considerably above the lowest at which it should work properly, it then flashes-back, at least at one side, and the mixing-tube receives a charge of carbon. Practically, the writer finds that a fire which runs night and day through the winter needs to have its mixing-tube thoroughly cleared out every season; but he has also discovered that this is an operation impossible of performance. In certain types of gas-fire, otherwise excellent, the mixing-tube consists of an O shaped pipe, broken in the centre of one side for the gas-jets and air-inlets, and perforated along the other with the burner orifices. The bends, however, are so sharp that a wire brush or similar instrument cannot be run through it. Tapping on wood or stone does not remove the accumulated and carbonized deposit. Boiling in water is better, but not wholly effectual. All that is needed is that the tube should be drilled at both ends, tapped with a suitable gas-thread, and gas-plugs put in. Then the plugs could be withdrawn and the whole cleaned out properly. The writer has several specimens of one maker's fires where the mixing-tube has orifices at the ends (presumably for convenience in casting it); but these orifices are filled with non-removable plugs riveted or otherwise fixed in.

Another trouble with old gas-fires which are still in use is due to the addition of water gas to the coal gas they have to burn; the gas-jets and air-inlets not being adjustable. The makers are, of course, not to blame for this; but care should be taken that all modern fires sold for employment in districts where the proportion (if any) of water gas is liable to vary should be given proper adjustability. The writer has recently had to take heroic measures to stop the "popping" noise made by a favourite old fire in his bedroom when turned down to a certain point, as he was beginning to suffer seriously from insomnia. Consumers are not all millionaires prepared to purchase new fires each time the makers introduce improvements; so perhaps if new adjustable burners suitable for easy application to old stoves, or other devices with the same object in view, were to be put on the market at low prices, they might sell well in proper neighbourhoods, and a slight but distinct grievance against modern gas firing be prevented from growing to serious proportions.

Within a comparatively short period of time, the incandescent gas-stove with its "iron fire" or with "iron frets," which was so popular, has almost disappeared from the market, and its place has been taken by the apparatus with "ball fire." This may well be a distinct advance from a technical aspect; but from the standpoint from which the present article is written, it is questionable whether the change is altogether an improvement. In exhibiting a gas-fire to a possible purchaser, or in making efficiency tests or the like with it, the fire is naturally run at, or close to, its highest point; but in everyday life, a gas-fire is often wanted to give as little heat as it will. Owing to the large number of extremely warm days in the winter, when the air is very "damp"—that is to say, close to its saturation point—and owing to the sensitiveness of the semi-invalid to high saturation, the fire is quite frequently lighted in order simply to "dry" the air (*i.e.*, to decrease its percentage of saturation). Outside the laboratory, air can only be "dried" by raising its temperature; but an amount of extra dryness (if the inverted expression may pass), gratifying to weak lungs and throat, can be conferred upon it by a very small rise in temperature. On these occasions, the invalid says he feels "cold," which is nearly always the human way of saying he feels "damp;" for if the temperature is raised appreciably, as shown by a thermometer, the same person soon proclaims that he feels too hot. Moreover, the sensation of being cold is usually a subjective one (in the circumstances with which we are now dealing) and, dyspepsia apart, immediately disappears when the person has ocular reason for making himself believe that he is cold no longer. A visible fire is thus the cure, but not necessarily a powerful or really heat-giving fire.

Now, the modern gas-fire, with clay balls, glows brightly enough when running at, or nearly at, full power; but, in the writer's experience, it gives distinctly less light—*i.e.*, heat to the eye, or radiant heat—when turned down to its lowest point. A fire with frets is incandescent at its lowest point; whereas to give an equal amount of light, and therefore organoleptic heat, a ball-fire must be consuming more gas—so much gas that when the thermometer outside is 50° or thereabouts, and a drizzling rain is falling, it cannot be tolerated in a room of medium size. It is quite possible to make a room look warmer, and at the same time to reduce its temperature, by lighting a fret-fire, owing to the stimulated ventilation—a double effect at once gratifying and beneficial to the occupant whenever the day is "muggy." The iron fret is by no means perfect; for it warps until its middle portion no longer glows properly. But the frets are so cheap that they can be renewed without sensible cost. In these circumstances, the writer cannot refrain from regretting the old fret-fire, from usually retaining it himself, and from recommending it to friends of the proper temperament.

All this is pure and ridiculous sentiment, no doubt; but if the world is controlled primarily by money, sentiment takes no bad second place as a compelling force.

⁂ Since the foregoing article was put in type, the author wishes it to be made abundantly plain that, when referring to non-condensing incandescent gas-fires, he means only the complete, self-contained incandescent fires, sometimes termed "frame-fires." The plan of building an erection of clay balls or the like inside an existing coal grate, and heating them by means of bunsen burners fixed underneath, was not contemplated for various obvious reasons.

Sanitary Value of Water Analysis.

At the recent meeting in New Orleans of the American Association for the Advancement of Science, Professor Leonhard P. Kinnicutt, the President of the Chemistry Section, delivered an address on the value of water analysis from a sanitary point of view. Referring to the modern system of bacteriological examination, he said that in its early days it was claimed that the final criterion as to pollution of a water would be furnished by aid of this science; and though the hope had not been fulfilled, the information that could be gained was often of the highest importance. It not only aided in the interpretation of the chemical data, but might of itself show, almost without question, that a given water was polluted. It could not, however, determine, except very roughly, the amount of pollution or the present condition of the polluting matter; nor did it give much, if any, information as to past pollution. If the pollution was recent and of any considerable amount, a careful bacterial examination would show the fact, and probably better and more convincingly than chemical analysis; but if it was more remote, more information could, as a rule, be drawn from chemical data. As a general statement, it might be said that a bacterial analysis, while it would furnish information as regards recent and continuous pollution, gave none at all as to the past history of a water, and in this respect it differed from a sanitary chemical analysis. To form a judgment as to the wholesomeness of a water, the source, whether surface, ground, or artesian, must be known. A survey, even of a surface water, though it might show whether or not the water was polluted, did not give information regarding the amount or condition of the polluting matter. With ground and artesian waters, it often supplied very little information; and an opinion regarding the character of such waters must, as a rule, depend upon the sanitary analysis.

The Woodall-Duckham Vertical Retorts.—In referring to this subject last week, it was stated that the vertical retorts are to be put into the New Poole works of the Bournemouth Gas and Water Company. Alluding to this statement, the General Manager (Mr. H. W. Woodall) writes: "My Directors have decided to put in more vertical retorts; but these will be at the gas-works at Bourne Valley, and not the New Poole works."

SOME LEGAL NOTES ON CONTRACTS AND SPECIFICATIONS.

By C. E. Brackenbury, Assoc.M.Inst.C.E., of the Middle Temple.

[A Paper read, Feb. 27, before the Meeting of the Society of British Gas Industries.]

My first word must be one of congratulation to the new-born "Society of British Gas Industries;" and within the scope of those congratulations must be included the person whose mind conceived such a Society, and the writer whose pen has supported it so ably in the Press. Besides these, there are those upon whom has fallen the first work of organization, and those who have assisted in and encouraged that work by their membership. For the task of forming any new Society is one that, in my opinion, calls for no little effort and no little courage. That I believe to be particularly true in the case of the Society of British Gas Industries, because what was the condition of things before it was called into being? On the one side, there was the organization of the productive portion of the gas industry—the gas engineers and managers; on the other side, there was nothing but a more or less inchoate mass of the constructive portion of the industry—the contractors. The latter were mere individual units, who, though trading with the same persons in the same industry, yet had no means of collective communication, of seeking advice, of making representations, of remedying grievances, or of checking abuses. The internal history of the gas industry might have been different during the last twenty or thirty years had such an organization as you have just formed been in existence. Your Society has, therefore, put an end, once and for all, I hope, to the day of aimless and helpless isolation in the ranks of gas-works' contractors. They were dumb; and you have given them a voice. They were homeless; and you have given them a meeting-place. They were solitary units; and you have provided means for social intercourse. In short, you are endeavouring to evolve union out of disunion, and to raise the whole status of the contractor.

If there were anything in all this which was, or could be, in the slightest degree antagonistic to what I have called the productive portion of the gas industry, it is needless to say that I, as a member of the Institution of Gas Engineers, should not be here. But my sixteen years' connection with the gas industry—from contractor's workshop to gas-works' management—has given me a sufficiently comprehensive outlook to know that the strength and well-being of one portion of the industry do not signify any corresponding weakness or ill-being of the other portion. On the contrary, the vitality of one-half reacts beneficially on the other; and so the soundness and healthiness of the whole gas body are secured. All, therefore, who have the best interests of the gas profession at heart should extend to you the warmest friendship and the most cordial co-operation.

The special objects of your Society are most admirably set out at length in one of your circulars; but there is one object which to my mind is worth all the rest, and the striving to give effect to which is enough, in itself, to enlist everyone's sympathy and support. It is: "To promote just and honourable practice in the conduct of business and to suppress malpractice." Your power in this and other directions will necessarily, to some extent, depend upon your numbers. But numbers are not everything, although there is considerable strength in them; and that strength, I believe, you are bound to have. But whether or no, the fixed determination and loyal co-operation of a few can do much to eradicate any unfair and dishonourable practices that may exist.

The mention of numbers leads me to say a word, if it is not presumptuous, as to a particular division of your classes of membership—I mean the class of Associates, Assistants, or Juniors, or whatever name you may give them. I should like to see your Society adopt a wide and embracive suffrage, and at an early stage attach to itself a large body of young men who are preparing themselves for a commercial career. There is quite as much need, if not more, for careful training and study on the part of commercial students, as for technical students. We all "live and move and have our being," thanks to Trade; and the coming generation of British traders will have to be fully equipped in order to hold their own. This Society can do much, if it will, to ensure this result as far as its own branch is concerned.

One other suggestion, if I may be allowed. Form the nucleus of a commercial and technical library at once. It need cost but little or nothing, and it will grow as you grow, and prove itself a source of usefulness and of information.

The Society's Legal Position.

Now what is the legal position of such a Society as yours, as at present constituted? In the eyes of the law, it has no separate and distinct entity, and any transactions with third persons that it may enter into would be governed by the ordinary common law, and the individual member making the contract would be personally liable. If, however, your Committee authorized that member to enter into the transaction, the persons authorizing it would be liable out of their own pockets. From the mere fact that certain persons are on the Committee, the law does not imply that authorization has been given. It is only evidence of it; and the question as to whether or not such authorization has been given has to be decided upon the particular facts of each case. ["*Todd v. Emly*," 8 M. & W., 505.] But, by incorporation under the Companies Acts, 1862 to 1900, your Society would at once become a distinct legal person with all the rights and privileges of a separate individual. In law, "Brown Limited" is an altogether different person from "Brown"—even supposing that it is a "one-man" company and that he and his wife and daughters were the only subscribers to the Memorandum of Association. ["*Salomon v. Salomon and Co., Ltd.*" (1897), A.C. 22.] So distinct is this legal individuality that although a foreigner cannot own a British ship, yet an incorporated English company of seven or more foreigners can, as by their incorporation they become an English "person." Of course, in the event of your Society being incorporated, the word "Limited" would, under license from the Board of Trade, be omitted from your descriptive name; and you would forthwith take equal legal rank with corresponding societies.

Development of Laws and Industries.

All laws may be said to spring from custom; and as man's necessities widen, so the scope of laws develops. What we call "Common Law" is really the survival of those particular customs which, by their utility, have become general and common to the whole realm. As the commerce of the country extended, so the generality of the usages of merchants had to be recognized; and these customs were welded into the body of our Common Law, largely by Lord Chief Justice Mansfield in the middle of the Eighteenth Century. Where the Common Law provided no remedy, or only an inadequate one, for any wrong suffered, "Equity," as practiced in the Courts of Chancery, stepped in and gave the desired relief. Now these two great divisions of our law are, by the Judicature Act of 1873, amalgamated to some extent into one body of law, administered in the same Courts. The Chancery Division of the High Court still deals with such matters as partnerships, mortgages, trusts, and contracts relating to real estates. The statutory laws passed by Parliament—the paramount power in the land—are now, of course, the main source of new laws, which have to be interpreted in the Courts of Justice.

The wonderful discoveries and inventions of the beginning of last century—including the rise of our own gas industry—caused both a commercial and social revolution. Special conditions required special legislative treatment; new trade developments necessitated new enactments; and so gradually there was built up the whole of our industrial and commercial laws as we now know them. The establishing of gas companies and gas-works called into being all its many and important allied trades, which your Society now for the first time represents. Each one of these particular trades has some laws that will apply to it in an especial degree, and the application and interpretation of which call for some special knowledge and qualification. All are more or less interested in, and affected by, the laws of banking and of limited liability companies. Then the law of bailments, by which is meant the delivery of goods to be taken care of, or to be carried, or to have something done to them, or to be let out on hire—and which includes all such matters as carriage by ship or railway, and the letting out on hire of gas stoves or fittings—would undoubtedly be of particular interest and importance to some of your members. Then, again, patent laws might appeal especially to some; and the law of trade marks to others. All are concerned with questions of insurance and, particularly just now, with assessment of rates. The rather complicated points involved in the law of principal and agent, touch all of us; and though we do not want personal experience of them, we may be brought into business contact with the laws of bankruptcy. Of very great interest, and one may say of almost daily and hourly importance, is the subject of trade-libel, which means words which injure a man's trade without affecting his personal character. So also are words which disparage the goods manufactured or sold by another—a risky line of conduct, which I am afraid is sometimes still followed.

Any one of these special topics might be expounded at length; but my immediate object is just to offer a few notes on the subject of contracts and specifications—a subject of vast extent, and upon which I can only deal in the time at my disposal in a very brief and cursory way.

Elements of Contracts.

All contracts can be reduced to a communicated offer on one side and an unconditional acceptance on the other. When the offer is accepted by the other party, it becomes a promise. When both the offer and acceptance are in writing, or by word, or by conduct, the contract is called a "simple" contract. Where there is a writing under seal, it is known as a "specialty" contract. The former requires some "consideration" or return (however slight) to make it valid; but the latter does not. If an offer is made by post, the inference is that the acceptance should be communicated by the same means. ["*Henthorn v. Fraser*" (1892), 2 Ch. 27 C.A.] So, if the offer be made by telegram, an acceptance by letter may be evidence of unreasonable delay; and the offer may meantime be withdrawn. ["*Queuerdnaine v. Cole*,"

32 W.R. 185.] There is an important point to be remembered in contracts by post. The offer contained in a letter is not communicated until the letter is received; but the acceptance of that offer is communicated from the moment the letter containing that acceptance is dropped into the letter box. ["*Household Fire Insurance Company v. Grant*," 4 Ex.D. 216.] Thus, say a gas company offers to take goods from a contractor. The contractor posts his letter of acceptance; but it gets lost, and is not received. The gas company is none the less bound to the contract. So, also, if after the contractor had posted his letter of acceptance, he received a wire from the gas company withdrawing their offer, such withdrawal (notwithstanding the fact that it was received by the contractor before the gas company got his letter of acceptance) is inoperative, and the contract is complete. ["*Byrne v. Van Tienhoven*," 5 C.P.D. 344.]

Tenders.

But tenders which are continuing offers must be carefully distinguished from ordinary tenders. Thus, say a corporation invites tenders for the supply of miscellaneous articles and stores for its gas-works in such quantities as may be required during twelve months. Here the contractor is bound to supply the goods; but the corporation is not obliged to order them. The acceptance of the tender did not make a contract upon which the corporation could be sued. The contractor was taken to have made a continuing offer, which the monthly or periodical orders from the corporation would turn into a promise, and so make each time a fresh and complete contract. ["*Great Northern Railway Company v. Witham*," L.R. 9 C.P. 16.] The usual condition in an advertisement for tenders—that the company does not bind itself to accept the lowest or any tender—is not necessary to be inserted. ["*Spencer v. Harding*," L.R. 5 C.P. 561 (1870).] From what has been said, it will be seen that a contractor is fully entitled to withdraw his tender at any time before acceptance of it has been posted. If also a formal written contract has to be entered into, before this is done, and notwithstanding that there may have been an acceptance of his tender, he may yet withdraw his offer, for there has been no completed binding agreement. ["*Kingston-upon-Hull Guardians v. Petch*" (1854), 24 L.J. Ex. 23.]

Corporations.

As regards corporations, the general rule is that they cannot bind themselves by contracts unless under their seal. But there are exceptions to this, as where the matters involved are of trifling importance, of daily occurrence, or of urgent necessity, or "convenience amounting almost to necessity," in which cases the contracts are binding though not under seal. ["*Church v. Imperial Gas Company*" (1838), 6 A. & E. 846.] What will amount to necessity varies according to the nature of the corporation. If it is a trading corporation, it may make all contracts without seal that come within the ordinary scope of its business, as a gas company's contract for the supply of meters ["*Beverley v. Lincoln Gas Co.*" (1837), 7 L.J. Q.B. 113.] If, however, it is a municipality or other local authority, the necessity will have to be very obvious to justify any departure from the strict rule. Section 174, subsection (1.), of the Public Health Act, 1875, says, that "Every contract made by an urban authority whereof the value or amount exceeds £50 shall be in writing, and sealed with the common-seal of such authority." In the face of this, if a contractor does work for an urban authority exceeding £50 in value and without seal, he must be prepared to take the consequences; for he will not be able to recover anything from them. ["*Young v. Mayor of Leamington*," 30 W.R. 500; "*Hunt v. Wimbledon Local Board*," 4 C.P.D. 48.]

Contracts Requiring Writing.

There are some contracts which, although they need not be in writing, require some note or memorandum of them to be in writing, before they can be enforceable. They are set out in Section 4 of the Statute of Frauds—that is, for the prevention of frauds—1677, which says (*inter alia*): "No action shall be brought . . . . upon any agreement which is not to be performed in the space of one year from the making thereof . . . unless the agreement upon which such action shall be brought, or some memorandum or note thereof, shall be in writing, and signed by the party to be charged therewith, or some other person thereunto by him lawfully authorized." Agreements "not to be performed within the space of one year" means those which are incapable of being completely performed within twelve months from the making of them. Thus, if you engage a manager for a year, to start from to-morrow, that is an agreement within the section of the Statute of Frauds; and to be enforceable, there must be a note of it signed by the party to be charged therewith. So if you had signed the note or memorandum, but not the manager, he could enforce the agreement against you, but you could not enforce it against him. ["*Smith v. Neale*" (1857), 2 C.B. (N.S.) 67.]

There is another section 4, which is also of great importance—namely, section 4 of the Sale of Goods Act, 1893. It is as follows: "(1) A contract for the sale of any goods of the value of £10 or upwards shall not be enforceable by action unless the buyer shall accept part of the goods so sold, and actually receive the same, or give something in earnest to bind the contract or in part payment, or unless some note or memorandum in writing of the contract be made and signed by the party to be charged, or his agent in that behalf."

Nothing need here be said about the interpretation of this clause except perhaps to add that the acceptance and actual receipt of the goods does not necessarily mean actual physical delivery over of them; and that acceptance is effected "when the buyer does any act in relation to the goods which recognizes a pre-existing contract of sale." [Sec. 4, (3).]

Warranty or Condition.

Passing over the various circumstances that will render contracts either void or voidable—such as mistake in the subject-matter, fraud, misrepresentation, or illegality—we may consider for a moment the importance of the distinction, as it affects vendors of goods, between a warranty with them and a condition concerning them. A warranty is made at the same time as the contract itself, but collaterally; and the breach of it does not end the contract, but only entitles the purchaser to sue for damages, or to claim a diminution of the price. A condition, however, is part and parcel of the contract, and being an essential term of it, failure to comply with it enables the purchaser to reject the goods, and treat the contract as at an end. Whether it be a warranty or condition, has to be decided upon the construction of each contract. The maxim that in general is applicable to sales and such transactions is *Caveat emptor*, "Let the buyer beware;" but the Sale of Goods Act, 1893, has codified some exceptions that may just be mentioned.

Section 14 (1.) says: "Where the buyer, expressly or by implication, makes known to the seller the particular purpose for which the goods are required, so as to show that the buyer relies on the seller's skill or judgment, and the goods are of a description which it is in the course of the seller's business to supply, whether he be the manufacturer or not, there is an implied condition that the goods shall be reasonably fit for such purpose." It is important to note that there is also no exception as to latent undiscoverable defects. ["*Randall v. Newson*," 2 Q.B.D. 102]. So that if I buy gas stoves or fittings from a manufacturer or supplier, for the particular purpose for which they are made, and I rely on their being suitable, and it turns out that they are not, or that there is a hidden defect in them, the manufacturer or supplier will be liable for any damage that may be caused through such a defect. The Act further provides that there shall be an implied condition that the goods shall correspond with the description; that they shall be of merchantable quality; and that the bulk shall come up to the sample.

Entire or Divisible Contracts.

How may contracts be brought to an end, or determined? Obviously by performance, or by agreement, whether it be by rescinding the contract or by substituting one contract for another, a new one for an old one. Then, from one cause or another, it may be found impossible to carry out the contract, and though this does not necessarily exempt the contractor, it does so in certain cases; and it is now usual for him to protect himself under this head by a "strike clause," or some similar provision. Again, as we have already seen, the breach of some conditions will under particular circumstances, terminate or discharge a contract. In this connection, it is important to remark the effect of a breach on an "entire" or "lump sum" contract, and on a "divisible" or "instalment" contract. In the former, you have to finish the whole of the work or you can get no payment at all. An ironmonger agreed to make some old gas-chandeliers "complete" for a ten-pound note. He did half of them, putting in work to the admitted value of £5. But he did not complete his contract; and what is more he could not recover a single halfpenny. ["*Sinclair v. Bowles* (1829), 9 B. & C. 92]. If you take on a lump sum contract, before you can legally demand any payment, you must either completely finish the work, or be prevented from doing so by the fault of the other party. ["*Appleby v. Myers*," L.R. 2 C.P. 651.] But if the contract is a divisible one, and you are delivering by instalments, the probability is (for the matter is not free from doubt, and the authorities are not consistent) that a breach by one party will not entitle the other to repudiate the whole contract. ["*Simpson v. Crippin*" (1872). L.R. 8 Q.B. 14, where "*Hoare v. Rennie*" (1859) 29 L.J.Ex. 73 was not followed.] To avoid these difficulties, of course, the usual practice now is to make special arrangements for part-payment during the progress of the work.

We have thus far glanced at component parts of contracts, noted some of their peculiarities, observed some of their special requirements, and seen how they may be discharged. It now remains for us to look at the clauses of a specification, such as we are familiar with in the gas industry, and follow out their legal or moral bearing.

Specifications.

We all know what specifications are, and we need not therefore define them. They are written descriptions of work required to be done, and have for their object the further elucidation of drawings, if any, and the giving of information to the contractor as to the scope of the contract, the character of the work, the details of the materials, and the general conditions. We know how some specifications fulfil these requirements, and how some do not. I have sometimes thought that in many cases there would be a better chance of getting good work promptly done if there were no specification at all, but more reliance placed on the reasonableness and good faith of the contractor. For some specifications merely succeed in bewildering the practical engineering contractor, and in hampering him with needless

restrictions, which only increase the cost and delay the execution of the work. A specification that does not assist, or does not make things clearer to the contractor, is worse than useless. They seem to me to be sometimes written from a most one-sided and even prejudiced point of view, in a sort of jailor-like spirit, which says: "Now I have the chance to make a binding contract, and bind you it shall, without any loop-hole of escape." That to my mind is neither good sense, good engineering, good policy, nor good morals. It is, of course, the duty of the engineer to safeguard to the fullest extent the interests of his employers; but my point is that such specifications as I have indicated do not protect those interests, although that undoubtedly is the motive of their writers. Beyond a certain reasonable limit, excessive stringency defeats the very object of it. There is this further aspect of the question. One might say to the engineer who compiled such an exacting specification, hedged round with onerous conditions, barricaded with restrictive clauses, and smothered with penalties—one might say: "But, my dear fellow, you surely do not intend to entrust your important work to any contractor of such a rascally description, as he must be if the terms that you seek to thrust upon him are necessary." No! I say such terms in any contract are impolitic and abusive, are not calculated to produce good and successful work, and are subversive of the best interests of the engineering profession in general and the gas industry in particular.

Sometimes there is a separate formal contract, apart from the specification; but it is generally better to have one document only, both for convenience sake, and to avoid discrepancies, and to enable the contractor to see at once before tendering what it is he is undertaking.

Engineer and Contractor.

It is important to understand the true position and relationship between the employer and his engineer, and between the engineer and the contractor. In preparing designs of any work, the engineer is the servant of his employer, and must show reasonable skill and competence in what he does. When, however, the engineer acts in superintending the contractor's work, the engineer thereby becomes the agent of his employer, and can bind that employer by all acts and orders which fall within the general scope of his employment. Such authority belongs to the engineer by virtue of his position as engineer; and it is futile and void for an employer to endeavour to shield himself by saying that he never gave the engineer authority to act for him. Of course, if the employer had given notice to the contractor that his engineer had only limited power, the matter would be on a different basis. But, in the absence of any such intimation, the contractor is entitled to assume that the engineer has full authority; and, therefore, the contractor can claim for work done by the engineer's orders. ["*Kimberley v. Dick* (1872) L.R. 13 Eq. 1.] It is essential, however, to remember that such orders must fall strictly within the scope of the engineer's employment as regards the particular contract he is supervising; and in general, the engineer has no authority to make material modifications to, and alterations of, accepted drawings and specifications. ["*Cooper v. Langdon*" (1841), 9 M. & W. 60.]

Between the engineer and contractor there is, in law, no relationship of master and servant. The result of this is that the engineer may be as negligent as he likes, so far as the contractor is concerned, and need show no skill at all; yet the contractor will have no remedy against him. ["*Scholes v. Brook*" (1891), 63 L.T. 837.] To make the engineer responsible toward the contractor, the engineer must have been guilty of acts of fraud. It follows from this that faults and mistakes in an engineer's drawings do not enable the contractor to recover from the employer any loss he may have sustained in consequence of those errors.

Drawings.

The subject of drawings raises many points on which it would be well to have some uniformity of practice and of payment. To some extent, the days when the engineer made all his own drawings (down to the smallest detail of what he required) have gone by—being hastened perhaps by the modern tendency of specializing. A consequence of this is that manufacturers of special apparatus are now asked to furnish full drawings of what they propose to supply. The tables have, in fact, been turned. Formerly (and, of course, to some extent to-day) the engineer made the drawings; the contractor carried them out; the engineer was not responsible; the contractor was. Now, the contractor-specialist makes the drawings, and carries them out; the engineer looks on; the contractor is responsible. So that in so far as the contractor is now responsible for his own designs, his position is so much better. But the point we are considering is the one of the supply of drawings; and it only seems fair that, inasmuch as the contractor-specialist has taken the place of the old engineer (as far as making the drawings is concerned), some remuneration should be the recognized thing where the designs are not accepted. The great distinction between an engineer's designs and a contractor's designs, seems to be this—that there is no warranty that the engineer's drawings can be carried into effect; but there is a warranty that the contractor's plans can be. The leading case of "*Thorn v. Mayor of London, &c.*," [1 App. Cas. 120, (1875)] is authority for saying that there is no warranty with the plans of an engineer. There the Corporation wanted to rebuild Blackfriars Bridge, and drawings were prepared by their Engineer, which showed among other things some caissons, which it was specified should be made as shown upon the drawings. After working for a long time, and spending a lot of money, the Contractor found that the proposed caissons were impracticable. He sued the Corporation for the money he had expended, but failed to recover it; for it was held that there was no warranty that the drawings could be carried out.

My own view is that if an engineer makes drawings, he ought to be prepared to stand or fall by them. He is within his rights in insisting that the contractor shall faithfully follow them, and shall adhere to the specification. But he ought not to demand that the contractor shall guarantee that the completed work carried out to the engineer's designs shall be a success. Upon the top of this, to seek to mulct the contractor of heavy sums of money in case of failure of the engineer's designs appears to be too outrageous a proceeding for anyone almost to believe that it has ever been known. He also apparently overlooks the fact that the greater the penalty he seeks to impose, the less must be his confidence in his own designs.

Guarantees and Extras.

From drawings, we may pass to "guarantees." They, like the drawings, vary a very great deal; and, as with the drawings, a contractor should not be asked to guarantee that over which he has no control. Yet it is sometimes found in specifications that he is required to guarantee the water-tightness of gasholder tanks that he has never seen; brickwork for two years after he has left it; against cracks in chimneys that he cannot control; machinery that he does not work; and against accidents that he cannot prevent. Guarantee clauses, after setting out the particular guarantees required, sometimes finish up with a general comprehensive sentence that is supposed to include all guarantees that may possibly have been omitted before. But there is a rule of law, known as the rule of *ejusdem generis*, which means that these general words shall only be interpreted in the same limited sense as applied to the particular words preceding them. There is also generally a clause stating that the plant shall be suitable for the work to be done and for the purpose for which it is intended. Where this is stated, the contractor is bound to make all additions that may be necessary to achieve the desired result; and this is so whether the engineer allows them as extras or not.

And what are extras? Some might say that they are a fruitful source of profit to lawyers and arbitrators. But in what do they consist? In something done or supplied, which by no construction or interpretation can be said to come within the terms of the original contract. Further than this, the contractor must be prepared to show that the alleged extras were done under a new contract, a fresh offer and acceptance, with an express or implied promise by the employer (or someone authorized by him) to pay for them. ["*Dobson v. Hudson*" (1857), 1 C.B. (N.S.) 652.] Where written authority is stated in the specification to be required before any extras are done or alterations made, it is imperative on contractors to adhere strictly to these instructions, if they are to make any claim for them successfully. [*Per* Erle, C.J. "*Thames Iron-Works Co. v. Royal Mail Steam Packet Co.* (1862), 13 C.B. (N.S.) 358.] If an engineer has included in his final certificate of acceptance any extras, the Court will not allow the employer to dispute any liability concerning them.

Certificates.

The right to withhold a certificate from the contractor puts him altogether in the power of the engineer, especially so when the granting of it is a condition precedent to payment. Suppose the contractor has done his work properly, and that the gas company's engineer, in good faith but negligently or unreasonably, refuses to give the certificate necessary before receiving payment. What can the contractor do? I say it with every regret; but the answer is apparently nothing. ["*Clarke v. Watson*," 34 L.J.C.P. 148.] The absence of the certificate appears to be an absolute bar to the contractor's right of action or recovery of his money. If the engineer, however, is not acting *bonâ fide*, or is in collusion either with his employer or with a rival contractor, then, of course, the contractor has a right of action against either the employer or the engineer or both. ["*Scott v. Liverpool Corporation*," 28 L.J.Ch. 236 (1858).] Such instances and hardships show how important it is for a contractor to look well ahead, and weigh carefully all the terms of a specification before putting his signature to it. If he accepts the engineer as a judge, the contractor must abide by his decision in all cases except that of fraud. But it seems to me that he would be a far wiser contractor if he selected some other tribunal to decide any questions that might arise.

Terms of Payment.

The bearing of the foregoing on the terms of the payment of a contract will be understood. Contractors are evidently so wealthy a body of men and such excellent financiers that they like to leave 4 or 5 per cent. of the amount of their contracts with the gas companies for a period of one or two years after the contracts are completed. And this, too, at the rate of no per cent. per annum for interest! In some cases, I believe, their generosity is even greater than I have put it at; for I have heard of as much as 20 per cent. of the contract amount being left without interest in the hands of a gasholder purchaser. For my own part, I should have thought that, as contractors' workshops are very expensive things to keep going, as their labour bills must be very high, and as they must have large and regular outgoings in payment for

their material and supplies, it would be more consonant with common-sense and fairness for those with surer and more regular incomes to pay more promptly and in larger instalments.

TIME OF COMPLETION.

In Law, as distinct from Equity, if there was a breach of the time of completion clause, it gave the employer the right to repudiate the contract and to refuse payment. In Equity, however, it was considered that repudiation of the contract was too strong a proceeding for a mere breach of time; and so where the time was not found to be an absolutely essential matter—not of the "essence of the contract" as they put it—the Court of Chancery said a time-breach was matter for compensation, but not for rescission of contract. Now since the Judicature Act (to which I referred at the beginning) law and equity are fused together, and the equity rule as to time prevails. This does not mean, of course, that there is now any laxity in the interpretation of the time-clauses of a specification, but merely that the harsh legal remedies have been toned down. Time may still be made "of the essence of a contract" by express notice being given to the contractor, or by both parties distinctly agreeing that it shall be so. Delays caused by the employer will prevent his claiming successfully against the contractor for breach of a time guarantee; and so also, as a general rule, will orders for extras and alterations. ["*Thornhill v. Neats*" (1860), 8 C.B. (N.S.) 831.] But not where the contract included the alterations that might be ordered, even though without extension of time it was impossible to complete the work by the date specified. ["*Jones v. St. John's College*" (1871) L.R. 6 Q.B. 115.] Where the employer has been the cause of delay—as, for instance, where foundations or gasholder tanks are not ready—the contractor is entitled to claim damages for any loss he has suffered. ["*Roberts v. Bury Improvement Commissioners*" (1870), L.R. 5 C.P. 310.]

PENALTIES OR LIQUIDATED DAMAGES.

We are all of us familiar—some of you I dare say unhappily too familiar—with the usual "penalty" clause of a contract. You know how it is generally headed and called "Penalty Clause," and then how in the body of the text there is a reference to "liquidated and ascertained damages" of so much that is to be paid for each week that shall elapse between the specified and actual date of completion. Some insatiable specification writers, not satisfied with this, even go on and add "notwithstanding any claim that may be set up according to law;" as though the erroneous confounding of "penalty" and "liquidated damages" was not bad enough, they must go further, and endeavour to place themselves on a pinnacle above the majesty of the law of England itself. Penalties are not the same as liquidated—*i.e.*, "made clear," from *liquidus*—damages. There is quite an important distinction between them, and one which is not generally realized. If the sum fixed is a penalty, the Court will sweep it away, and the contractor will only have to pay the actual amount of damage. The specification may call the sum anything it likes—penalty or liquidated damages—but what it actually is "is a question of law to be decided by the Judge on a consideration of the whole instrument." ["*Sainter v. Ferguson*," 7 C.B. 727]. In my experience of gas contracts, I think that nearly all of the sums labelled "liquidated damages" have really been penalties, which would not, without evidence to support them, have been recoverable in a Court of Law. I have known of several such penalties being paid—amounting in all to hundreds of pounds, and throughout the gas world it must total up to thousands—and I can only explain their payment, not on the ground of satisfying any just demand, nor because it was thought they were legally due, but merely in the hope of propitiating the gas powers that be, or in the fear of otherwise being struck off the list of contractors to be asked to tender. Not, indeed, a very healthy state of mind or of industry in any case.

OBLIGATIONS OF EMPLOYER.

Again, there is often an article in the specification in which the "Obligations of the Contractor" are set out. But there should also be a corresponding clause embodying the "Employer's Obligations." For in all contracts there are implied obligations on the part of the employer or company to give the contractor every reasonable assistance in carrying out the work, and to place no impediment in his way of successfully executing it. The company must allow the contractor and his men all proper access to the site of operations. All foundations must be completed and handed over within sufficient time to enable the contractor to carry out his portion of the work. Any plans required by the contractor from the company must be given him within a reasonable time; otherwise an action will lie against the company for damages, the measure of which will be the amount of profit the contractor would have made out of the particular contract had it been carried out. Or if the contractor does not want to rescind the contract, he may go on with it, and be exempt from his own obligation to complete by a fixed date, and also claim damages for any loss he may have sustained. ["*Bush v. Whitehaven Trustees*" (1888), 52 J.P. 392.] So that you see there are obligations to be entered into, and responsibilities to be borne, on the company's side as well as on the contractor's. But as to which has to run the greater risks, to carry the heavier burden, to suffer the more inconvenience, to feel the less independent, and to receive a lower recompense, there can be no doubt.

For these reasons, I feel that there is still need for a more general adoption of that fair and broad-minded basis for contractual relationships in the gas industry that we know exists in some quarters. An unfair, harsh, and one-sided contract hurts the contractor, hurts the engineer, hurts the company, and hurts the gas profession. It should be fully and heartily recognized that between engineer and contractor there is strong mutuality of interest, that they are close partners working together in the same business, that each has need of the other, and that sympathetic encouragement and friendly thanks from one to the other can only raise the status of their common calling, and still further advance the progress and prosperity of British gas industries.

EXPLOSIONS OF COAL GAS AND AIR.

At a recent meeting of the Royal Society, a paper on the above subject was read by Mr. Bertram Hopkinson, M.A. He explained that the explosion of homogeneous mixtures of coal gas and air at atmospheric pressure and temperature is investigated by means of platinum resistance thermometers placed at various points in the explosion vessel; the mixture being fired by an electric spark at the centre. Each thermometer consists of a loop of bare platinum wire, about 5 centimetres long, placed in series with a battery of constant potential, and a reflecting galvanometer of short periodic time, the deflection of which is recorded photographically on a revolving drum, on which the pressure of the gas is recorded. The arrival of the flame at any wire is marked by a sharp rise in its resistance; and the rate of rise, when corrected for the time-lag of the wire, gives a measure of the velocity with which the gases about it combine.

It is found that with a mixture consisting of 1 volume of gas and 9 volumes of air, the flame spreads rapidly from the spark in a somewhat irregular manner, but at a rate of roughly 150 centimetres per second. A thermometer placed near the spark shows a sudden rise of temperature to nearly 1200° C. (about 2200° Fahr.), after which the temperature remains almost constant till the flame approaches the walls of the vessel. With the rapid rise of pressure which then occurs, the adiabatic compression of the burned gas at the centre causes the temperature there to rise to nearly 1900° C. (about 3450° Fahr.), with the result that the wire of the thermometer generally melts. With a weaker mixture, containing 1 volume of gas and 12 volumes of air, the spread of the flame is very much slower; about 2½ seconds elapsing before all the gas is burned. Owing to the slow propagation of the flame, convection currents play an important part during the process of ignition. The burned gases rise to the top of the vessel, and the last portion of gas to be ignited is not close to the wall, but immediately under the spark and a short distance from it. But though the flame is propagated very slowly, the combustion of any given portion of gas, when once started, proceeds almost as rapidly as in the stronger mixture. There is no "after-burning" in the sense of the slow completion of a reaction already begun. Within one-tenth of a second before the time of maximum pressure, some gas is still unburnt; within one-tenth of a second after, all the gas is completely burned, and the mixture everywhere is in chemical equilibrium.

The bearing of the results on the question of "after-burning" in the gas-engine is discussed in the author's paper; and it is shown that the observed specific heat of the products of combustion, together with some loss of heat during the passage of the flame through the compression space, accounts for all the peculiarities of the gas-engine diagram. The form obtained with weak mixtures is due simply to the very slow propagation of the flame, and not to any delay in the attainment of chemical equilibrium at a point which the flame has already reached.

GAS-ENGINE INDICATORS.

The Junior Institution of Engineers, assembled at the Westminster Palace Hotel last Friday evening, had before them a paper of considerable length by Mr. L. F. de PEYRECAVE on the above subject. There was an historical preface; and then followed a detailed examination of the merits and demerits of the various types of indicators, with an account of personal investigation by the author and Mr. F. White, B.Sc.

The conclusions to which the author has been led as the result of these indicator tests are: (1) The paramount importance of obtaining a good fitting piston and general absence of friction in the moving parts, features which can easily be tested by putting the indicator under steam, and taking a straight line card. With a reliable indicator, the distance between the two lines, he holds, should not be greater than the thickness of a fine pencil line. (2) The outside spring is certainly to be preferred for gas-engine work, though the enclosed type gives very good results at times. (3) For accurate observations, it is advisable to calibrate the springs for the temperature at which they are intended to work. It is not safe to rely on the scales that are marked on the springs by the makers. Moreover, the springs should be re-calibrated after they have been in use some time, so as to take into account possible differences which may arise through continual use. (4) The

desired temperature for the calibration is preferably obtained by jacketing; the required pressure on the indicator piston being obtained by some other means than that of steam. (5) The pencil motion should combine lightness with stiffness and absence of friction; the joints of the links should have good bearing surface, especially those in which there is considerable motion. (6) If the springs are calibrated for the working temperature, the average inaccuracy of an indicator of the standard type on a gas-engine may be considered as about 2·5 per cent.; and if this precaution is omitted, the error may reach anything up to 7 per cent. (7) In the average gas-engine indicator, the error due to friction is the most serious difficulty, and appears to amount on the average to over 2 per cent., which accounts for the somewhat high average inaccuracy.

To the discussion on the paper, Mr. W. A. Tookey, Mr. E. A. Dowson, Mr. Dugald Clerk (the President), Mr. J. C. Dobbie, and others contributed. The great use of indicators in the study and development of the gas-engine was pointed out by Mr. Tookey, who also complained that there were very few real hints in the paper to users of indicators. He proceeded to subject certain parts of the paper to criticism, and illustrated his points by a liberal use of the blackboard. The Mahot recorder he pronounced a very useful instrument indeed. Mr. Dowson was complimentary to the author on the care that was so manifest all through the paper in the carrying out of the tests. He spoke of the necessity of, for ordinary safety, standardizing the instruments from time to time. Regarding the Mahot recorder, he also referred to its usefulness, particularly where the gas was likely to vary in quality during the tests. Mr. Dugald Clerk offered his congratulations to the author for the accurate work he had done. He was very glad indeed to find that the younger engineers had been attending to this question of indicators, because in times past there had been published many very extraordinary results which were really not due to the actual facts themselves, but to the errors in indicators. Even in well-known tests by fairly well-known men, indicator differences were so great that one was not surprised to find great changes in apparent mechanical efficiency. He had, for instance, seen tests published showing an indicated efficiency of (say) 37 per cent. in the form of indicated work. Then he had found, in comparing that test with the brake test, that the brake efficiency did not exceed 29. In another test, they would find an indicator efficiency of only 34 or 35, and the brake efficiency something over 30. One was rather tempted to wonder how such results could be obtained, especially as a good deal of faith was pinned upon the (say) 37 per cent. They all wanted to give a high efficiency on the indicator. He feared occasionally they were misled; and instead of having a really high indicator efficiency, they had an exceedingly high indicator error. He referred to the fact that he was a member of the Committee of the Institution of Civil Engineers for the determination of a standard of efficiency for gas-engines, and mentioned that, at the beginning of last year, the Committee carried out a test, at the works of the National Gas-Engine Company, on three engines, varying in power from 5 to 50 brake horse. The Committee were then, although used to working with indicators, very much struck with the difficulty of attaining accuracy. The importance of getting an accurate indicator could not be overestimated, He proceeded to explain, by the aid of the blackboard how, in a recent investigation, he had obtained a series of diagrams in rather a peculiar way. In his concluding remarks, he reverted to the difficulty of getting correct work, and said that, at the present, even specialized people could not be sure of the accuracy of their results. To a very large extent, the discussion was composed of comment on details affecting the various types of indicators.

THE USE OF CARBURETTED WATER GAS IN THE BUNSEN BURNER.

By Masumi Chikashige.

[A Paper read before the Society of Chemical Industry.*]

The defects of water gas as a fuel in the chemical laboratory were experimentally tested some time ago, in Kyoto, Japan, by H. Matsumoto and the author. The results were given in a paper read before the London Section of the Society of Chemical Industry in 1904. There being no coal gas available for the use of the Kyoto University laboratories, a method of preparing carburetted water gas, much on the lines followed by Professor Vivian B. Lewes, was devised by a Committee appointed by the University, and including the author. In this process, heavy petroleum oils are injected with steam into the water-gas generator filled with ignited coke. The gas produced is passed through a superheater, loosely packed with fire-bricks, and then through a scrubber, after which treatment and purification it enters the gasholders. It is not now the purpose of the author to go into the details of this process, as worked out by the Committee; his object is only to make known the behaviour of this gas when used as a laboratory fuel.

* An abstract of this paper appeared in the "Journal" for Feb. 27 (p. 566).

The mean composition of the gas does not differ much from that of coal gas—

	Vols. per Cent.
Heavy hydrocarbons	5·3
Methane	16·8
Hydrogen	51·7
Carbon monoxide	15·4
Carbon dioxide	0·6
Oxygen	0·5
Nitrogen	9·7

There have been, occasionally, some wide deviations from the mean composition, one of which will be noticed in the next paragraph. Only a brief account of the behaviour of the carburetted water gas is necessary, because this hardly differs from that of coal gas to which it approximates in composition.

Partial Combustion of the Gas.—The carburetted gas was tested in the same way as simple water gas itself had been, by the Smithells and Ingles apparatus, in order to find out what are the proportions of the constituents of the partially-burnt gas. Two samples were examined in this way—one (*a*) which had very closely the mean composition shown in the table, and another (*b*) which deviated largely from that in having about 20 volumes per cent. of carbon monoxide, and only 3 volumes per cent. of heavy hydrocarbons. Side by side with the results obtained are placed those given in the former paper.

—	Coal Gas.	Carburetted Gas.		Water Gas.
		a	*b*	
Water	14·9	16·7	16·7	17·0
Hydrogen	10·9	12·8	12·1	20·0
Methane	trace	0·9	0·9	0·3
Carbon dioxide	3·8	3·1	3·2	8 8
Carbon monoxide	10·2	10·4	9·3	19·5
Oxygen	—	—	—	0·1
Nitrogen	60·3	56·1	57·8	34·3

The carburetted gas in burning soon becomes similar in composition to burning coal gas. Even the (*b*) sample did so, notwithstanding the defects in its composition at first; and in consequence of the fact that the hydrocarbons present in it made it possible to let in, through the bunsen tube, a sufficient proportion of air without causing the flame to descend the tube as it would then do in the case of unenriched water gas (see former paper).

Size of the Bunsen Flame.—It was pointed out in the former paper how much greater a flow of gas was needed to produce with non-carburetted water gas the same sized flame as that given by coal gas in the bunsen burner. To the numbers there given can now be added that for carburetted gas. To get the usual flame, one about 15 cm. long, the flow of gas per hour has to be in the case of—

	Litres.
Coal gas	120
Water gas	300
Carburetted gas	160

Therefore, the triangular orifice of the ordinary bunsen burner for coal gas requires to be only slightly enlarged—that is, in the proportion of 4 to 3—in order to get the same sized flame with the carburetted water gas.

Effects of the Flame upon Laboratory Vessels.—The carburetted gas has no action upon copper, platinum, or porcelain vessels, greater than that of coal gas. A porcelain crucible placed in the bunsen flame only gets a deposit of carbon on it when it is put so low as to touch the inner cone of the flame. Similarly, a platinum vessel only loses in weight in the flame when kept for a long time touching the inner cone, or when the flame is surrounded by a muffle.

Effects upon the Air.—The products of the nearly finished combustion of the carburetted gas being, unlike those of plain water gas, the same in composition as those of coal gas, the use of the gas in insufficiently ventilated laboratories is not more injurious to health than that of coal gas.

In the course of the brief discussion on the paper, Dr. Harold G. Colman said he could confirm this Japanese experience with regard to the use of carburetted water gas. He had frequently had occasion to use, for laboratory purposes, ordinary carburetted water gas—now largely made in this country for admixture with coal gas—and there was no difficulty in the matter, although the percentage of carbon monoxide might rise much higher than that given in the paper, sometimes amounting to 32 or 33 per cent.

The Electric Light and Eyesight.—The New York Correspondent of the "Daily Express" writes: "The glare caused by the modern system of lighting streets and buildings with powerful electric arc lights is declared by Mr. I. B. Marks, the President of the American Society of Illuminating Engineering, to be largely responsible for the admitted increase in defective eyesight. At a recent meeting of the Society, Mr. Marks declared that much of the trouble due to this cause would be removed if the light sources could be concealed, and the illuminating power from them derived from reflected rather than direct rays.

THE MIDLAND JUNIOR GAS ENGINEERING ASSOCIATION.

The March Meeting of the Association was held on Saturday in Birmingham, under the presidency of Mr. F. J. BYWATER. There were two papers on the *agenda*—the first by Mr. W. E. Caton, of Derby, on "Work with Illumination and Street Photometers," and the other by Mr. C. M'Pherson, of Nechells, on "Flame." Before proceeding to this portion of the business, however,

The PRESIDENT said he would like just to refer to the recent meeting of the Midland Association of Gas Managers, at which it was agreed that the President and Hon. Secretary of the Junior Association should be *ex-officio* members of the Committee of the Senior Association. It was an honour for their Association to be recognized in this way; and he had no doubt the members would appreciate it very much. Now there was thus a permanent link between the two Associations, he hoped they might look forward to seeing more members of the senior organization at their meetings.

A discussion then took place as to the advisability of having the transactions of the Association printed in pamphlet form at the close of each session; and ultimately this course was unanimously agreed to on the motion of Mr. W. LYCETT (Birmingham), seconded by Mr. R. S. RAMSDEN (Burton-on-Trent).

Mr. W. E. CATON (Derby) then read the following paper on

WORK WITH ILLUMINATION AND STREET PHOTOMETERS.

The question of the candle power of various lamps and burners is one which daily comes into greater prominence. The author, therefore, thinks that gas engineers should do more in the way of testing lamps and burners in positions where they are fixed. The subject the writer has chosen will bring before your notice two photometers—an illuminating power photometer, and a street photometer—both of which are designed for this purpose, and which he has used with considerable advantage.

THE ILLUMINATING POWER PHOTOMETER.

The illuminating power photometer differs from most photometers in this respect, that the readings are recorded in parts of a candle-foot. [A candle-foot, of course, being the amount of light given by a standard sperm candle at a foot distance.] The use of this photometer has been very exhaustively dealt with by Mr. Henry Fowler, the Gas Engineer to the Midland Railway Company, in a paper read by him before the Manchester District Institution of Gas Engineers on March 7, 1903, but presented for the previous December meeting.* For the benefit of those who have not perused this communication, I will read some of his remarks as an introduction to my paper.

The theoretical calculation of the amount of illumination on any plane may be easily arrived at if the whole of the light is concentrated at one point by the following method: In fig. 1,

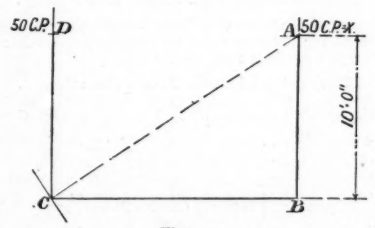


Fig. 1.

let A be the source of light, having an intensity in every direction of x candles, and B a point directly below it. We know that the illumination at B is equal to x divided by A B^2 (A B being in feet) and is therefore $\frac{x}{A\,B^2}$ of a candle-foot. At C, on a plane at right angles to A C, the illumination is $\frac{x}{A\,C^2}$; but on a plane at right angles to A B is $\frac{x}{A\,C^2}$ multiplied by the cosine of the angle of incidence B A C, and therefore is equal to

$$\frac{x}{A\,C^2}\ \text{Cos. B A C} = \frac{x \times A\,B}{A\,C^2 \times A\,C} = \frac{x \times A\,B}{A\,C^3}$$

This is simply the candle power multiplied by the cosine of the angle of incidence and divided by the square of the slant distance. A curve (1) of the illumination along B C is shown under fig. 2 as a full line, in which x is assumed to be 50 candles and A B to be 10 feet. This is, of course, the curve for a single light. If other lights have to be considered, the illumination along C B is the sum of the respective illuminations given by them. Assuming another light to be at D (fig. 1), A D being equal to one-and-a-half times A B, the illumination from these two lights will be the sum of the curves 1 and 2, as shown by curve 3 (fig. 2). It will be seen that the actual amount of illumination on a given spot—such, for instance, as on any floor of a room, on a desk or table, &c.—can be theoretically calculated.

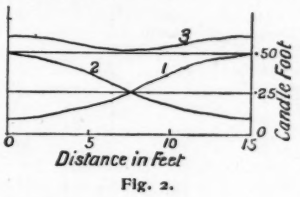


Fig. 2.

Various forms of illumination photometers have been devised; but the one the author has been using—the Preece-Trotter photometer—is the most reliable. Fig. 3 shows a section through this type of photometer, which consists of a body A, of 3-inch diameter tube, attached to a stand B, which may be placed directly on the floor or on a tripod as required. C is an amyl-acetate lamp screwed into a casing D from beneath, which allows the flame to be adjusted to a standard height, which is indicated by means of the gauge E. The ends G G of the photometer are secured by means of bayonet joints. Near the lamp is provided a mirror, to allow of the flame being inspected without taking the end off.

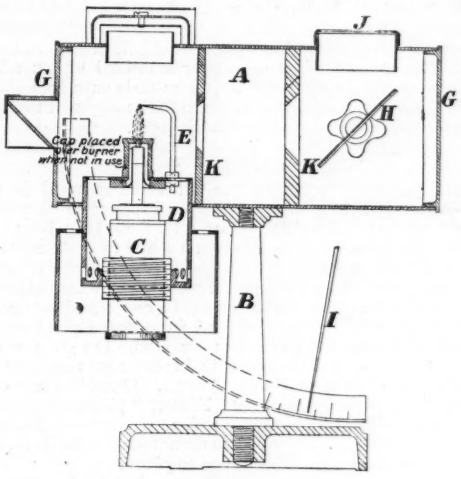


Fig. 3.

The inclined Bristol board H is directly pivoted to the lever I, the end of which works on the quadrant marked with the reading in parts of a candle foot. The disc J is held down by a circular rim, and has in it a slot lying at right angles to the axis of the barrel. K K are metal screens with pear-shaped holes in them, which prevent, to some extent, the stray reflections which take place in the interior of a box however carefully it may have been blackened. The scale is marked for readings from 0 to 2·2 of a candle-foot; the amyl-acetate lamp giving on the bar a reading of 0·25 candle.

To take a reading, it is necessary to move the lever backwards and forwards, exposing the Bristol board to the standard light at different angles, which is seen through the slot in the circular cardboard disc. The illumination on the Bristol board increases as the same approaches the vertical, and *vice-versa*. The rays of light from the lamp under test shine on to the circular cardboard disc; and by moving the lever, as previously stated, until the same density of light is obtained on the disc and through the slot, the reading on the quadrant scale can then be observed. It will, therefore, be seen that this is practically a "Flicker" photometer. With this photometer, one is able to actually read the illumination on a given spot in parts of a candle-foot which has been theoretically calculated. Any difference under or over is, of course, accounted for either by the light not giving its theoretical candle power, or owing to the globe, &c., or by the help the surroundings lend to the lamp.

From any reading thus taken, the actual candle power of the lamp can be calculated by the aid of the formula given. It will be found that the candle power varies considerably with the angle at which it is taken. Take, for instance, an ordinary incandescent burner, 10 feet high. The theoretical illumination is greatest directly underneath. But in practice the highest illumination will be found at a short distance away, owing to the shadow cast by the burner; and the further you get away, the candle power will slightly increase, owing to the burner not cutting off from view so great a portion of the mantle. This is overcome by the inverted incandescent gas-burners. With this type of photometer, curves of illumination can be taken longitudinally and crossway of a room, shop, or large building, for comparison (say) with another room lighted in a different way.

Some of the disadvantages of this type of photometer—which is, the author believes, the only one of its kind in use—are that

* See "JOURNAL," Vol. LXXX., p. 1541.

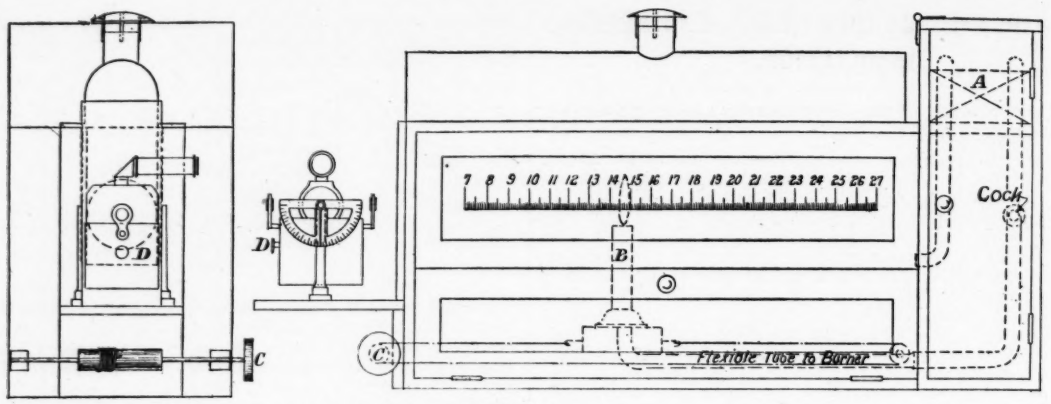


Fig. 4.

no readings can be taken directly under a light; while the amyl-acetate lamp, giving a reddish coloured light, requires a considerable amount of practice to read accurately when testing electric arcs or incandescent gas-lights, also, owing to draughts affecting the standard flame, it can only be used outside on a still, fine night. The author thinks if some similar photometer was designed at the present time which would do away with the colour difficulty, and in which a higher standard was used, a demand for it would soon spring up, as he feels sure something after this kind would be found very useful to the engineer in these days of keen competition with the electric light.

The Street Photometer.

The street photometer which the author has used is the Simmance-Abady. Fig. 4 shows a form of this type of photometer, which consists of a box about 2 ft. 8 in. long by 11 in. wide by 1 ft. 6 in. high. Inside this box a small tank A, containing pentane, is fixed, which supplies the burner B with pentane vapour by means of rubber tubing. This burner, when adjusted to the proper height, gives a light equal to one standard sperm candle, and is capable of being moved from end to end of the box by means of a cord actuated by a screw C. On the front of the box is a blue glass scale, marked in inches and tenths of an inch from the centre of the "Flicker" head. Outside the box is fixed one of Simmance and Abady's "Flicker" photometers,* by means of which lights of blue, green, red, or any other colour can be tested with accuracy. The whole is mounted on a carriage, and is capable of being wheeled from place to place.

To make a test of a lamp, it is necessary, after having decided on the horizontal distance away from the lamp, to find the angle of elevation of the lamp, then bisect this angle, and fix the "Flicker" head to this bisected angle, as shown on the divided scale. Start the "Flicker" going by turning the screw D, and move the standard burner, by the aid of the screw C, to a position where the flickering disappears. Take notice of this position as indicated by the pointer on the blue glass scale. The horizontal distance between the flicker-head and the centre line of the lamp being accurately measured and the angle of elevation taken, it is easy to find the distance from the flicker-head to the centre of the light. The distance, expressed in inches squared, divided by the square of the distance as noted on the blue glass scale, gives the candle power of the lamp. This photometer cannot be used to test the illumination on a given plane, as can the Preece-Trotter illumination photometer, but only records the actual candle power of the lamp under test. Of course, from this figure the theoretical illumination of one lamp or burner in terms of a candle-foot on a given plane, can be calculated.

Perhaps a few tests made by the author, with the assistance of Mr. G. Twigg, in the streets and Market Hall of Derby, may be of interest. All the gas-burners in use in the streets of Derby are fitted with 4 cubic feet per hour governors.

The Corporation decided that the flaming arcs were the best form of lighting; and they have, needless to say, adopted this method, having electricity works of their own, whereas the gas is supplied by a Company. In the short time, however, that these have been in use, numerous complaints have been made, as the colour of the light is most objectionable; and the lamps being so high up, no light is given on the stalls, and thereby additional lamps have to be used for lighting these.

It will be seen from the above tests that all gas-burners in use in the streets, &c., come much nearer their nominal candle power than do any of the electric lamps; and it behoves any of us who may be called upon to get out comparative estimates as to the cost of lighting a street or building, to bear this in mind. If corporations were possessed of one of these photometers, it would be an easy matter for their lighting superintendent to make a similar comparison of the candle power given by various lamps in position. This would enable him to see if he was really getting the light it was estimated would be given if such and such lamps were fixed, and they would be far better able to judge which was the better illuminant for street-lighting purposes.

* A full description of this appeared in the "Journal," Vol. LXXXV. p. 31.

Tests Made in the Streets.

Description of Lamp.	Observed Angle of Elevation. Degrees.	Candle Power.
3-light inc. electric, nominal c.p. 96	30	68·0
,, ,, ,,	25	80·0
3-light inc. electric, nominal c.p. 48	60	29·2
2-light inc. electric, nominal c.p. 32	55	17·2
Single electric, nominal c.p. 32	68	19·7
Pear shape, electric arc (alternating)	52	402·0
,, ,, ,,	43	430·0
,, ,, ,,	53	229·0
,, ,, ,,	45	332·0
,, ,, ,,	45*	531·0
Ditto, but circular globe and direct current	48	470·0
,, ,, ,, ,,	40	382·0
,, ,, ,, ,,	48†	785·0
,, ,, ,, ,,	39	761·0
Janders electric arc	38	225·0
,, ,,	38	352·0
,, ,,	32	277·0
No. 4 Welsbach Kern, single 4 cubic feet per hour	43	78·0
,, ,, ,, ,,	29	103·0
,, ,, ,, ,,	37	82·0
,, ,, ,, ,,	25	102·0
,, ,, ,, ,,	56‡	54·5
,, ,, ,, ,,	36	61·9
3 No. 4 Welsbach Kern burners	43	152·0
,, ,,	32	182·0
3-Light Welsbach self-intensified	26	316·0
Sugg's burner, 4 cubic feet per hour	54	33·2
,, ,,	34	50·4
Bray's "C" burner, 4 cubic feet per hour	54	63·5
,, ,,	34	99·5
Bray's flat-flame, 4 cubic feet per hour	52	15·0

The above gas-burners are all fixed in a street-lantern with opal top.

* Best candle power obtainable. † This being by far the best lamp in the town. ‡ Mantle in poor condition.

Tests Made in the Market Hall, Derby.

[These tests were made when the Town Council had under consideration the substitution of the flat-flame gas lighting by some other method, and therefore the lamps were only temporarily fixed.]

Flaming Arc (Nominal Candle Power, 2500).

Distance from Lamp.	Angle. Degrees.	Candle Power.
10 feet	58	unreadable
20 ,,	39	1555
30 ,,	29	1745
40 ,,	23	1751

Open Arc (Nominal Candle Power, 1500).

10 ,,	57	252
20 ,,	40	242
30 ,,	29	577

5-Light Cluster Sugg's High-Pressure Incandescent Gas-Burners, under 3-feet Diameter White Reflector, Consuming 40 Cubic Feet of Gas per Hour (Nominal Candle Power, with 50 Cubic Feet of Gas per Hour, 1500 candles).

10 feet	55	unreadable
20 ,,	35	971
30 ,,	27	1126

The author thinks it will be agreed that incandescent gas-lights, whether low or high pressure lamps are used, with proper attention, give the best illumination effect, if only placed close enough together. This, perhaps, in some towns is a drawback. But taking into consideration that in some of the principal streets in London high-pressure gas-lamps are superseding the electric arc lamps, it speaks volumes in favour of this form of lighting for street purposes; and he therefore looks forward to the day when high-pressure gas lighting in our large towns will be the chief mode of illumination.

Discussion.

Mr. A. O. Jones (West Bromwich) remarked that the chief point to be noticed in Mr. Caton's paper was the extraordinary difference between the nominal and actual power of the electric lamps. The flame arc, for instance, was of 2500 nominal and 1700 actual candle power, and the open arc 1500 nominal and 500 odd actual. There was no doubt the flame arc was the best electric lamp now to be had; and it was rather interesting to compare

the high-pressure gas-lamp with it. He had taken out one or two figures for this purpose. A flame arc requiring 580 watts per hour, and giving 1745-candle power, with electricity at 4d. per unit, would cost 2·32d., or ·0013d. per candle-hour. A Sugg cluster lamp giving 1126 candles, and consuming 40 cubic feet of gas per hour, with gas at 2s. 6d. per 1000 cubic feet, worked out at 1·2d. per hour, or 0·0010d. per candle-hour. This showed, therefore, that incandescent gas was still ahead of the electric light. Taking the open arc lamp as requiring 400 watts per hour and giving a light of 577 candles, this would cost, with electricity at 4d. per unit, 0·0027d. per candle-hour, which was more than twice as much as high-pressure gas. Enclosed arcs gave much less light than open ones; so that there was no need to make a comparison with them. Of course, there was another point about arc lamps—the renewals were very heavy. Mr. F. W. Goodenough had stated in a recent paper that this item for arc lamps amounted to something like £4 a year, which was considerably in excess of the outlay on incandescent gas-lights.

Mr. S. T. Smith (Walsall) said the paper would be a most valuable one to them, especially when they took into consideration the keen character of the competition of electricity at the present time. There was a tendency on the part of local authorities to give electricity every benefit; and even when tests were made, the members were frequently prejudiced in advance, and so would be inclined to give a preference to electricity, whether it was the better light or not. They had an idea it was better, and so would have it at all costs. In fact, the question of cost was sometimes quite a secondary one. Arc lamps were often perched up 20 feet high, and sometimes more; and instead of illuminating the streets, the light was expended up above. Mr. Caton had gone to a great deal of trouble in giving them the results of tests; and they were very striking. He did not say what was the nominal power of the electric arcs at Derby; but presuming they were the usual 2000 candles, about one-quarter of the nominal power was obtained from them. Then with regard to flame arcs, these were very nice when one was not more than 10 or 20 feet away from them; but when one got a distance away, they threw a tremendous shadow. The light did not seem to travel in anything like the same degree as did that from incandescent gas-lamps; and at the present charges for electric current, people could not afford to have the flame arcs close together. Consequently, there were bound to be black spaces in between the lamps. Mr. Caton had obtained some remarkable results. At an angle of 43°, with a single 4 foot Kern burner, he got 78 candles, or 19 candles per foot. With a cluster of three No. 4 Kerns, he got 152 candles at the same angle. He would like to know how this cluster was arranged. Of course, if it was an ordinary tripod, he only got the light from two burners; but if it was in the form of two burners on a level and the centre one placed higher up, he would get the light from all three. There was, however, to his idea, a more interesting matter still—the Welsbach self-intensified lamp. He had had a fair experience with street lighting; and he was very much in favour of these lamps, even over high-pressure ones. But with a three-light self-intensified lamp, which, according to the Welsbach Company, had a nominal power of 900 candles, Mr. Caton only got 316 candles. He thought this was rather a blow, seeing that they were so used to pointing out that the 2000-candle arc gave a light of only about 500-candle power. Another instance of what could be got from gas was the Bray "C" burner. In this case, Mr. Caton got 99 candles from the 4-feet burner, which was equal to 25 candles per cubic foot. Mr. Caton used lamps with opal tops; and he would like to know whether they had reflectors as well. With opal tops, the light converged to the centre of the lamp; and unless there were reflectors to throw it out, the space between the lamps was not lighted. Unfortunately, it was the practice of street-lighting authorities to place their lamp-columns 60, 80, or even 100 yards apart, and to expect the whole of the street to be illuminated. A distance of 50 yards between the lamps was ample for incandescent burners. Mr. Caton's paper and figures would prove most useful when they had to consider the question of town lighting; and it would furnish them with data when they had to compete with electricity.

Mr. G. W. G. Tatam (Saltley) said he thought the most interesting portion of the paper was the comparisons the author made, and which previous speakers had dealt with, between the theoretical and actual illuminating powers of the various lamps. It appeared that there was something else to look to besides illuminating power, and that was the way in which the light was diffused over the surface to be illuminated. There were many lamps of very high candle power which would give a shadow beneath for about 15 feet. These lamps, to his mind, were not doing a great amount of good. He had come across some figures on the subject of illuminating power and diffusion of light, in which the Welsbach system was compared with many types of electric lamps. With the Welsbach, the light was obtained chiefly in a horizontal direction, while the illumination was very fairly equal above and below. With the inverted burner, of course, the maximum illumination was from the horizontal plane downwards. When they came to the Osmium lamp, they found that the maximum light was some 20° above the horizontal. This threw the light skywards; and so he did not think the lamp was suitable for general illuminating purposes. It was all very well for ceilings; but for floors it was really useless unless there was a tremendous number of lights. Perhaps the best of the type was the Nernst lamp, in which case the maximum light was in the horizontal plane, with a good diffusion above and below. With regard to the flame arcs, the maximum light was given between the angles of 30° and 45° below the horizontal, and there was practically no light thrown upwards; so that the flame arcs, except for the illumination of the floors of halls, &c., and streets, were of no use. Of course, many people said it did not matter about throwing the light up; but to his mind the light was wanted above as well as below. He quite agreed that frequently electricity was adopted for public lighting without sufficient consideration being first given to the matter; but in most cases (except there was plenty of money behind it) they found that, after a trial had been made of electricity, it fell out of favour. In his opinion, incandescent gas lighting would hold its own with any illuminant that might come forward.

The President, in proposing a hearty vote of thanks to Mr. Caton for his paper, said he quite agreed with the author's remark that this research work by means of a photometer on the subject of street illumination would well repay any trouble and expense that had to be incurred, because, as had already been stated in the course of the discussion, there was a tremendous lot of prejudice in the minds of local authorities at the present time in favour of electricity. Councillors were induced by the Press to think that electricity was a great thing; and frequently they allowed themselves to be led away without really considering actual results. He thought himself that street illumination at the present time was too much a matter of nominal candle power. It was "nominal" because a lamp that gave 1000-candle power in one position, might, if moved to another street, give quite a different result. It was impossible to say that the power of a lamp was 1000 candles in every street, because in some positions it would get assistance from the surroundings—white walls, &c.—whereas in other deadly dark places it would get no such help. Clustering also was an important thing which was altogether lost sight of when the nominal power of lamps was stated. He had recently come across a case in which a high-pressure lamp of 1000-candle power, and consisting of three burners in a cluster, when tested as a whole, did not give more than 400 or 500 candles. The result obtained depended upon the manner in which the clustering was carried out; and the trouble, as Mr. Smith had mentioned, could be easily obviated. There was no doubt that they were going to get a lot of assistance from the inverted burner, which had made tremendous strides. It would be found very useful both for outside and inside lighting.

Mr. R. A. S. Browning (Saltley) seconded the motion.

Mr. Caton, in acknowledging the vote of thanks, remarked that the papers they had had up to the present had been chiefly in connection with the manufacture of gas on the most modern lines; but to hold one's own, it was also necessary to be up to date in the methods of using gas. He therefore hoped that next session they would have more members coming forward with papers in this direction. As to Mr. Smith's question regarding the candle power of the electric lamps, he paid a visit a few days ago to the electric light works at Derby, where he obtained the information that the direct-current arcs were 2000-candle ones, and the alternating lamps 3000 candles. As to the three-burner lamp Mr. Smith had drawn attention to, the lights were all clustered together in a tripod, so that they really only got the result from two of them. The self-intensified lamp alluded to was clustered in a similar way to the Welsbach Kern burners; but he must confess it was not giving its proper candle power. They, however, tested all they came across, so they thought it only fair to include it. The result obtained from the Bray gas-burner was rather startling, to say the least. They thought at the time it was a high candle power, and so went back and tested the lamp again, but with the same result. He could not answer for the gas consumption; but the lamps were supposed to pass 4 cubic feet. There were in most cases reflectors at the top of the opal lamps. As to Mr. Tatam's remark about the large shadow cast by a lot of lamps, this was where the advantage of the illumination photometer came in. If they could not—but, of course, they could in most cases—see the shadow with the eye, it was possible to do so with the photometer. They were indebted to Mr. Tatam and the other speakers for the figures they had given in connection with the cost and lighting power of electric and high-pressure lamps. He agreed with the President that the clustering of burners was a matter that wanted looking into. He himself had tested several burners singly, and then clustered; and the value obtained in the latter case was not nearly proportionate to that which was secured in the former.

Mr. C. M'Pherson (Nechells) afterwards read a paper, which was accompanied by many interesting experiments, and exhibits of various forms of incandescent lighting. See p. 652.

The Saxon-Snell prize was founded to encourage improvements in the construction or adaptation of sanitary appliances, and is to be awarded by the Council of the Royal Sanitary Institute at intervals of three years; the funds being provided by a legacy bequeathed to the Institute for this purpose by the late Mr. Henry Saxon Snell, F.R.I.B.A. The prize consists of £50 and a medal of the Institute, and is offered this year for an essay on "Suggestions for Improvements in Sanitary Appliances for use in Workmen's Dwellings and Labourers' Cottages under the Varying Conditions of Water Supply and Drainage usually Obtaining in Towns and Villages."

FLAME.

By C. M'Pherson, of Nechells Gas-Works, Birmingham.

[A Paper read before the Midland Junior Gas Engineering Association.]

Although it is becoming more and more generally recognized that the real difficulty in the problem of flame consists, not so much in producing efficient results for heating, lighting, and power, as in finding a satisfactory scientific explanation of the phenomena, yet in this brief paper it is not intended to attempt to add to the required information, but to deal with some interesting facts of the more practical application of flame to the gas-burner of high illuminating power, to mechanical apparatus for heating, and to internal combustion motors; demonstrating the principles by a few well-known experiments, and showing some of the best types of burners applicable to coal gas or to mixtures of coal gas and carburetted water gas.

The study of gas may, with advantage, be begun by considering the question of combustion. Combustion is commonly defined as energetic chemical action producing light and heat. For a thorough understanding of this problem, it is necessary to know something about the substances taking part in the chemical change. There are numerous varieties of substances which differ from each other in appearance, in chemical constitution, and in their behaviour when undergoing combustion—such as wood, peat, coal, mineral oils, &c. Each of these substances has a different temperature of ignition, and different calorific value. In order to burn with a flame, the substance itself must either be a gas, or be capable of conversion into gaseous form by heat.

The amount of heat given out by complete combustion depends upon the relative proportions of carbon and hydrogen which the fuel contains. It is possible, in the absence of external heat, for the temperature of certain substances to rise so high that the mass will burst into flame. This is known as spontaneous combustion; and the temperature at which light is emitted is called the ignition temperature of that substance. Other substances or mixtures require the application of heat to bring about chemical action. This heat may be applied in many different ways. As already mentioned, every combustible substance has its own ignition point, which may be illustrated by the lighting of an ordinary fire. First we light the match, then the wood, then the coal. All these, and many other substances, burn with flame; but if we try to ignite a piece of iron (which is not a gas, nor capable of forming a gas), it will only produce sparks.

Nature and Structure of Flame.

Flames differ in character, colour, and shape according to the composition of the burning mixture, and the method and process of combustion. If the flame of a candle or of coal gas be closely examined, it will be seen that the one does not touch the rim of the burner nor the other the wick of the candle. In the latter, the structure of the flame is altered by mixing another gas—nitrogen, air, or carbon dioxide—with the gas before it issues from the burner. The flame structure of a burning candle or gaseous hydrocarbons can best be seen by referring to figs. 1 and 2. Here, it will be observed, there are four distinct regions:

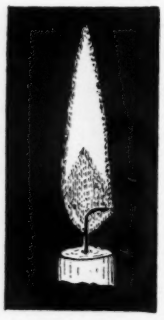


Fig. 1.—Candle.

Fig. 2.—Coal Gas.

(1) The dark central region; (2) the yellow central region; (3) the blue central region; and (4) the faintly luminous region.

The dark central zone consists of gasified hydrocarbons. The yellow region, which is, as a rule, the largest and gives off by far the greatest amount of light, is known as the luminous portion. The blue portion of the flame is the least in extent of any of the four divisions, and is probably caused by the combustion of hydrocarbons which have become mixed with a sufficient quantity of air to allow them to burn with an almost non-luminous flame. But it is probable that the combustion is incomplete, and that the reaction going on is the same as in the inner cone of the bunsen burner, which will be described later. The faintly luminous sheath is the region of complete combustion, in which those substances (mainly hydrogen and carbon monoxide) which have been incompletely oxidized in the other portions of the flame are finally converted into aqueous vapour and carbon dioxide. This corresponds to the outer cone of the bunsen flame.

The behaviour of combustibles is well illustrated by the following simple experiments: (1) If we strike a match, the frictional energy developed between the two surfaces (the head of the match and the composition on the box) is sufficient to raise the temperature of the head to the ignition point, and cause it to burst into flame. (2) A candle lit by application of heat from the flame of the match will continue to burn without further application of external heat. Here the ignition point of the hydrocarbons, which are first liquefied and drawn up into the wick by capillary action, is lower than the temperature produced by its own combustion. In this, as in all familiar processes of combustion, the oxygen of the atmosphere is indispensable. The nitrogen takes no active part in combustion; it merely mingles with the products, and reduces the flame temperature.

Now we can see the four distinct regions which have already been described—viz., yellow, dark blue, and faintly luminous. It will be observed that the wick bends outwards and becomes oxidized in the faintly luminous sheath at the same rate as the solid hydrocarbons are vaporized. This is a very important part of the candle-making industry. The manufacturers have to study the wick and its rate of combustion. This is, in itself, very complicated—much more so than at first sight appears. The luminosity of the candle flame is due to the burning of finely-divided particles of carbon in the solid state at a high temperature. The luminosity can be destroyed by reducing the temperature; and with a further reduction of temperature, it is possible to cool down the flame so much that it is extinguished. The dark middle portion of the flame is proved by analysis to consist of unburnt hydrocarbon vapours. We can burn them by the simple expedient of siphoning them down a small tube. On applying a a light, you have an ordinary candle flame *minus* a wick—a flame very similar to that obtainable from coal gas.

Bunsen Burners.

Now if air is admitted and mixed with a gas before it issues from the burner, the luminous area will be seen to have disappeared, and we get what is commonly called a non-luminous flame, containing no solid particles. Such a flame is that of the bunsen burner. To enable us to realize that air can in this way be admitted and mixed with the gas, we have first to understand the theory of injectors. The school boy often asks, "Why is it that the gas does not come out through the holes at the bottom of the burner?" Now many rather difficult looking questions are easily answerable when we fully grasp the fundamental facts. Let us take a simple case in point—viz., a small pipe ending in a nozzle, through which we have a supply of gas at a certain pressure. If this compressed gas be allowed to flow into the atmosphere, the great velocity at the point of constriction will produce in the immediate neighbourhood a partial vacuum; and in this way a suction is caused. The following experiment will make this clear.

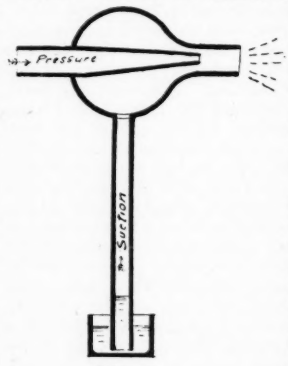


Fig. 3.

The flame-cone of the bunsen burner will be found to consist of two parts, or two shells of combustion—one an inner cone, in which combustion occurs with the primary air; the second, an outer cone of combustion, where the partially burnt gas is completely oxidized in the outside or secondary air. To prove that this flame-cone is hollow, we may depress a piece of paper and observe that the charred portion forms a ring. This may be taken as a section of the cone. Here you see that no combustion is taking place in the centre. Again, if we thrust a match in the middle of this flame-cone (or suspend it by a piece of wire), it will not ignite until brought within the active flame zone. Here it will be observed that the middle of a flame may have a temperature not much higher than that of the surrounding air; whereas if we take the edges of the flame, it is possible to melt platinum wire. To do this, the platinum wire must be very thin, and will require a temperature of something like 1775° C.—thus proving that the distribution of temperature throughout the whole volume of the flame is very uneven, and that there is a great variation of temperature within very small distances. This is an important point, which will again be considered in connection with the incandescent burner.

Bunsen Flame under Ordinary Conditions.

In the bunsen flame, there is just enough air added to the gas before it leaves the burner to destroy the luminosity—one volume of gas is mixed with about 2½ volumes of air. If more air be added—say, 5 volumes—the mixture becomes too explosive, fires-back down the tube, and continues to burn at the contracted nozzle. When the gas is burning below at the nozzle, the air supply is only about 1¼ volumes; and there is not sufficient for complete combustion. Gas burning under this condition gives off the well-known unpleasant odour, which is due to the formation of quantities of acetylene and other unsaturated hydrocarbons. Sometimes, however, the bad odour given off from a

bunsen flame is not due to its having struck-back, but because the combustion has been interfered with in another way. Take, for example, the lighting of a gas-fire. The cold material immediately surrounding the flame chills it, for the first few moments, and proper combustion is prevented.

Now let us try the effect of heating the mixture previous to inflamation. We can do this by heating a platinum or porcelain tube externally, and passing the gaseous mixture through the heated tube. Then it will be observed that luminosity is restored, and is entirely due to the added heat; for, if we remove the source of heat, the flame again becomes non-luminous.

The two component parts of an ordinary bunsen flame can best be illustrated by Professor Smithells's beautiful arrangement of two tubes, one of which slides over the other. With a large supply of air, he observed that the inner cone became greener and smaller, but when sufficiently explosive and ready to strike-back, the flame did not pass down the tube as a whole, but the green inner cone detached itself from the outer one, and passed down the tube, and could be arrested at the mouth of the smaller inner tube, while the outer flame continued to burn above. By this arrangement, he also proved that, when the inner cone was withdrawn to a distance, and the partially burnt gases were allowed to cool before the second stage of burning, there was a drop of temperature in the outer shell of the flame.

This brings us to the question of high temperature again—a question so important in the development of gas lighting. In order to attain the maximum temperature, it is evident that we must effect rapid and complete combustion. Now to do this, we must have the highest possible pressure of the molecules engaged in chemical combination. There are various ways in which this can be done. We can add more oxygen, or more hydrogen; we can use higher pressure of gas, or higher pressure of air, or vary the mixture so as to concentrate the flame area. Scientific authorities are still undecided as to which they will adopt to produce a flame of maximum temperature at a minimum cost. They are all trying to produce an explosive gaseous mixture that will burn in such a way as to heat a large surface of a mantle consisting of the refractory oxides of certain rare metals to a high temperature of incandescence.

Now let us take a few examples of the effect of modifying conditions: (*a*) Add oxygen to the flame of this bunsen burner, and we complete the combustion more rapidly. We also get a flame of much smaller volume, when burning the same amount of gas. This proves that the flame has not got to wander so far through the atmosphere to find the necessary oxygen to complete combustion; and from the smaller external surface here occupied, we must have a relatively higher temperature. (*b*) Add hydrogen instead of oxygen. This must be done at a considerably higher pressure, to prevent it from striking-back; and we get a flame of actively burning gas. (*c*) The burning of carburetted water gas will give us a small flame volume for the same reason. This is what makes the reading of a jet photometer much more unreliable when varying percentages of carburetted water gas are mixed with coal gas. (*d*) Higher pressure of gas or air will give us much the same result. (*e*) The previous heating or compressing of the gas or air involves similar principles, and the results are much the same—all giving a concentrated flame of higher temperature owing to the more rapid chemical combination brought about in these various ways. This is exactly what has been done in the Kern and other burners used in connection with the incandescent mantle. It will be observed that the gas passes into an inverted cone, which lessens the skin-friction of the primary air; thus enabling a larger volume of air to be admitted through the air-holes, and to get rapidly mixed with the combustible gas, while, at the same time, the angle at which the slots are cut in the burner-head gives a spinning action to the mixture issuing from the burner-tips. The inner and outer cones of this burner are split up into a series of small blue flames, which rest flat on the burner-head. Above this zone the flame is fairly homogeneous.

The Incandescent Burner.

Let us now examine the character of this high-temperature flame when we introduce it into the incandescent mantle. Here we have a transformation—viz., an extraordinary increase of luminosity, due to the partial conversion of energy from thermal to radial. Illustration of this conversion of energy may be shown by taking two flasks containing equal amounts of water at the same temperature and placed at the same distance from the respective flames. Heat one of the flasks with a bunsen burner, and the other with a bunsen burner having a mantle suspended—both burners using the same amount of gas. Observe the temperatures before and after the application of the two flames. This is a rough indication of the difference between the heat-value of the two flames.

If we take a mantle and place it in the different bunsen flames that we have just been considering, and look at the light emitted, we can see exactly that the luminosity increases with a flame of high-heating power. There are a number of different burners suitable for use in connection with the incandescent mantle. It will be convenient to refer to them as: (*a*) The low-pressure system. (*b*) High-pressure system. (*c*) Recuperative system. (*d*) Self-intensifying system. (*e*) Inverted system.

(*a*) *Low-Pressure System.*—In this system, the gas at the ordinary pressure which we have in the supply mains—say, anything between 1·5 and 3 inches water-gauge pressure—is used. By the various improvements made in the burners, it is obvious that, with the same initial gas pressure, we have higher light-giving results.

(*b*) *High-Pressure System.*—This differs from the low pressure in that power is required to supply the gas at a greater pressure than that supplied in the distribution mains. So we call anything above 3 inches high pressure. The compressing machines on the market are many; and the power to drive them may be taken from any convenient source. The burners may be the ordinary incandescent, adjusted to suit the different mixtures; but the best results are obtainable by using a burner specially constructed for the working pressure of the apparatus. There is, however, an alternative to this high-pressure gas, in the high-pressure air system, where the usual conditions are reversed. Compressed air, obtained by mechanical means at a pressure much higher than that of the gas supply (usually from 35 to 55 inches water pressure), is made to pass through a very fine calibrated nipple, where it meets with the gas supply. The result of this high-pressure air supply, applied at the head of the burner, is a very hot flame, similar to that of the blow-pipe. It must be remarked, however, that a slight variation of the gas pressure considerably affects the flame intensity, and consequently the lighting power.

(*c*) *Recuperative System.*—This is where the lost heat from the incandescent burner—which by the way, is not so very great as some people have imagined (I refer particularly to the fire insurance companies, who wished to raise their premiums on the advent of incandescent gas lighting)—is utilized to increase the temperature of the mixture before ignition. The air is admitted at the top and passed over the intensifier, which is heated externally by the waste gases, then passes down the tube to the inlet at the bottom of burner, where the mixing takes place at a temperature of about 130° Fahr. The light from the recuperative lamp is an improvement on the ordinary low-pressure.

(*d*) *Self-Intensifying System.*—There are many gas-lamps which are claimed as being self-intensifying (the recuperative may be classed under this head). The usual idea, however, is to have a long chimney, where the difference in temperature between the top and bottom, when the lamp is alight, is so great that the equalizing effect causes an increased rush of air through the lamp. This current of air, or draught as it may be called, would, at first sight, seem to be the opposite to that of the recuperative lamp; but it must be remembered that the cool in-rushing air is at a greater density, and consequently more highly charged with oxygen. The result is, there is a rapid mixing with an additional air supply to ensure better combustion. Many of these lamps give excellent results, and, of course, have the advantage of requiring no mechanical power.

Internal Combustion Motors.

It remains now for us to consider the part flame has to play in connection with internal combustion motors. It matters little for the present purpose of this paper whether we consider oil or gas motors, for both types are essentially flame-engines. It will be desirable to consider the special parts and their functions, so as to fix their names and operations in mind. This simple diagram will serve admirably for the purpose. We have the following main parts (see p. 654): A, cylinder with a surrounding water-jacket; B, piston fitted with rings to make it gas-tight, and, at the same time, made to slide easily in the cylinder; C, crank which converts the reciprocating motion of the piston into rotary motion; D, the space in the cylinder end in which the mixture of fuel and air is compressed and fired. The simple engine works on a four-stroke cycle—that is, the gaseous mixture is exploded once in every four strokes. In moving the piston from the back end of the cylinder, we draw in a mixture of gas and air, which, on the return stroke, is compressed. At the turning point of the third stroke, the mixture is fired, and the high pressure caused by the explosion sets the piston in motion; the pressure falling gradually as the piston moves forward. The first stroke is known as the suction stroke; the second stroke as the compression stroke; the third stroke as the working stroke; the fourth stroke as the exhaust stroke. It is necessary to provide automatically worked valves in order to adjust the mixture, compression, time of ignition, and exhaust.

This brief explanation will be sufficient to indicate how the four-stroke cycle engine works. The power comes from the explosive or working stroke, the engine being kept running between successive explosions by the inertia of the fly-wheel.

The questions of temperature, pressure, and ignition point of an explosive mixture in a heat-engine cylinder, working with different classes of fuels, deserve far more attention than they at present receive; and chemical experiments would require to be performed on ordinary working motors, not in a narrow glass or metal tube, where working conditions of expansion, conduction, radiation, &c., are not properly represented.

In all explosions there is a sudden rise of temperature, and a corresponding sudden change of pressure. A gun may be called a flame motor, having an intermittent action and working at a high pressure of from, say, 10 to 20 tons on the square inch. In the Maxim gun we have a solid fuel, such as gunpowder or cordite, working continuously, so long as the supply of fuel is maintained. In fact, engines may be constructed to work with any combustible material that will burn quickly enough to develop the requisite high pressure in an enclosed space. Much depends upon the rate of combustion of the explosive mixture. The

explosion of a mixture of coal gas and air in the combustion chamber, immediately after the compression stroke, is not really instantaneous. The time occupied by explosion is, of course, extremely short—a very small fraction of a second—but it has to be allowed for on the setting of the ignition valve or the electric sparking plug.

In working with inflammable mixtures in the internal combustion motor, it is necessary to compress the gaseous fuel for reasons of economy. It must not, however, be forgotten that any inflammable mixture only requires to be sufficiently compressed to ignite without any other means of inflammation. It may be seen, therefore, that we have to keep the mixture, during compression, at a temperature below its igniting point. There is no record of exact information as to the temperature of ignition of different gaseous mixtures; and, in the past, the engineer has had to try experiments for himself by increasing the compression with each gaseous fuel until the motor became unworkable by frequent pre-ignitions—that is, explosions before the piston has reached the end of the compression stroke.

Now the temperature which a mixture of gases attains upon compression, and at which pre-ignition occurs, depends largely upon the specific heat of the substance of the mixture, or (say) the nature of the gas used. It is found, for example, that with weak gases of the producer type, such as blast-furnace gas, compression may be carried very much farther than with, say, town gas or petrol vapour. In general, it may be said that the richer the gas the higher will be the flame temperature; but with a high percentage of hydrogen difficulty occurs from pre-ignition and back-firing in the engine cylinder. These factors prohibit that high degree of compression which would enable us to get the greatest efficiency. In order to increase efficiency by using a greater degree of compression, the temperature of compression must be maintained sufficiently low. This can be done in several ways—such as, by supplying additional air, and reducing the inflammability of the charge by efficient water cooling, or by adding a small quantity of steam or water. By these means the temperature can be considerably diminished, in spite of increased compression. Compression beyond 150 or 160 lbs. per square inch in a motor cylinder is accompanied by uncertain ignition, and adds to the expense of construction; motors having to be specially designed to withstand the high maximum explosive pressure. In small motors, care must be taken that the fuel is not condensed by the very cold walls of the cylinder when high compressions are employed; and in some cases it may be necessary to heat the cooling water and work it at about 200° Fahr.

The question of fuel for the internal combustion engine is of great importance; and there are many for us to choose from. At present the most suitable are: Coal gas or mixed gas as supplied from the town mains, producer gas, suction gas, water gas, oil, petrol, methylated spirit, &c. There is a wide and profitable field for the investigation of the properties of mixed fuel, such as mixtures of different gases, mixtures of alcohol and petrol, alcohol and oils, solutions of explosives, &c. There are, as yet, no records of reliable scientific experiments to enable us to generalize upon the results. In calculating the heat from the combustion of any kind of fuel, and subtracting the amount which is converted into useful work, there is always a very large percentage of waste carried off by the exhaust gases of the motor, and by the water, which abstracts heat from the cylinder walls. This waste must be utilized sooner or later, if great economy and improvements are to be sought in the conversion of heat energy into mechanical energy from internal combustion motors.

It may be said, without exaggeration, that the future of gas engineering is brilliant with promise—that the whole world is now alive to its possibilities, and that progress in the near future will be still more rapid than it has been in the past. England stands at the head of all nations in the production of medium-sized fixed gas-engines. Are the Midlands still the centre of gravity round which the gas world revolves? Here, in Birmingham, there is an awakening in engineering circles to the advantages gained by gas production and the various energies which can be developed from suitable gaseous mixtures. May this Association press forward, and keep alive "the spark that kindles" the study of the fascinating subject of flame.

Discussion.

Mr. G. W. G. Tatam (Saltley) remarked that the experiments had been most interesting, and very successfully carried out, which was more than could be said always. He had been particularly interested in the Smithells tube, by means of which they were able to trace a tremendous number of reactions that went on in the inner cone, and so on. He thought it would have been beneficial had it been mentioned that in the passage of the gas from the inner cone (where there was complete combustion) to the outer cone, the amount of acetylene would increase from 1 per cent. to as much as 70 or 80 per cent. This meant to say that the hydrocarbons existing in the gas, whatever they might be, saturated or unsaturated, tended to be degraded into acetylene during the passage from the inner cone to the outer cone. This was the case with the majority of flames, but more especially with flat flames. It was on flat flames, or luminous flames, that Professor Lewes performed his experiments on the formation of acetylene, or rather the mechanism of combustion. He did not quite agree with Mr. M'Pherson that the intensity of heat depended entirely on the quantity of carbon and hydrogen in the compound or the gases. It depended also on the latent heat, the heat of formation. With regard to acetylene, for instance, the luminosity of a flat-flame burner practically depended upon the tremendous amount of heat which was rendered latent in the

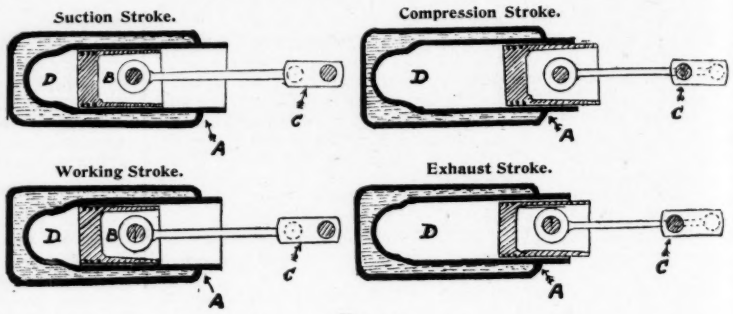


Fig. 4.

formation of acetylene being given out on the decomposition of the acetylene—that was, on breaking down the acetylene molecule, the heat of formation was given out and gave the carbon particles separated out with the disintegration of the molecule, a tremendous amount of heat, and consequently of luminescence. It had been proved that the quantity of heat given out by the formation itself would simply raise the carbon particles to a very dull red temperature; whereas the heat of formation which was released gave the intense incandescence to the carbon. Mr. M'Pherson had dealt pretty fully with incandescent lighting; and he had also instanced the effect of mixing various gases. It was of interest to them to see that it was not always the gas with the highest calorific value which gave them the best illuminating power. It was to a large extent the gas which took the smallest volume of air for its complete combustion that would give the best results in a mantle. He had got some figures which would explain what he meant. A coal gas of 540 B.T.U.—that was, an ordinary coal gas—required about 6½ volumes of air for its complete combustion. But if they took the intensity per foot of that mixture—that was to say, 1 foot of gas and 6½ volumes of air—they would find it was 72 B.T.U.; whereas from ordinary producer gas of 132 B.T.U., and requiring 1 volume of air, the calorific intensity given out would be 66 B.T.U. There was therefore not an immense amount of difference between the two. Then take carburetted water gas of 19-candle power and 587 B.T.U., requiring to be mixed with three times its volume of coal gas of about 15 candles and 540 B.T.U.; the calorific value of this mixture would be approximately 560 B.T.U. But adding about 4 volumes of air to 1 of the mixed gases, would give a calorific intensity of 112 B.T.U. per foot. Thus they would see that, for the incandescent mantle, they might have practically a gas of any illuminating power. In fact, on the Continent the gases used very often were simply very poor producer gases of extremely low calorific value. There was another point of interest which struck him, and that was the temperature of flames. For instance, if they took a mixture of hydrogen and oxygen and burnt it, they got a very intense temperature; but this temperature could not rise above what is known as the dissociation point of water. The hydrogen and oxygen, of course, combined together to form water; but the temperature reached in the flame—that was, the maximum temperature—was that practically of the dissociation of the water. He hoped they might have many practical papers on the lines of Mr. M'Pherson's. Of course, people with large works did not have an opportunity of going into the many forms of lighting; this was usually carried out by another department. Contributions of this description were therefore very instructive to them.

Mr. W. E. Cadwallader (Birmingham) asked whether (say) a 5-foot bunsen burner gave off more heat than a 5-foot ordinary flat-flame burner.

Mr. S. T. Smith (Walsall) said the paper would be most useful in teaching them the various ways in which they might get the greatest illuminating power from gas by the aid of the incandescent mantle. It required a great deal of study to derive the best results from different mixtures. He had had one or two trials with systems of high-pressure lighting, more especially with air under pressure—that was, by compressing the air to 2 or 2½ lbs. per square inch and regulating the gas supply to the mixture. One interesting fact brought out during the trials was that when on one occasion they unfortunately got the pressure up to 3 lbs., the mantles—apart from not standing it—gave practically no better light than with an ordinary incandescent burner. For some time they could not understand it; but on inquiry of the makers, they learned that the burner had been constructed for a mixture of air at 2 lbs. to the square inch. And from that point the light began to diminish. It was evidently one of those cases in which if air was added beyond a certain point, heat was lost. With regard to the regenerative system, of course, it was known that by regeneration a greater amount of heat was secured, and by bringing

this heat into the mixing chamber extra illuminating power was gained. A great point with reference to high-pressure lighting, so far as his experience went, was the cost of the compressing plant, as well as that of working. He had come to the conclusion that at the present time, when they had the self-intensifying lamp, the additional cost incurred by adopting the high-pressure system was not warranted. Certainly, a higher illuminating power was obtained; but the cost was so great as to be almost prohibitive. The following of Mr. Caton's paper by Mr. M'Pherson's was most admirable, because one had to know the character of flame and the nature of mixtures in order to obtain the best results from the incandescent burners of the present day.

The PRESIDENT remarked that he was sorry there was not a longer discussion, because it was a most excellent paper. However, he had great pleasure in proposing a very hearty vote of thanks to Mr. M'Pherson. It was a most fascinating subject; and whether or not it interested them now, it would have to do so in the future. The experiments the author had carried out on incandescent lighting demonstrated to them how very important was the question of flame and flame temperature in reference to the incandescent mantle; and he thought that they were all agreed that, as regarded lighting at all events, the future of gas was wrapped up in the incandescent mantle. Mr. M'Pherson had shown them that the luminosity of a flame increased very rapidly with its temperature—that was to say, the more complete the combustion of the gas that was put into the burner, the greater was the temperature, and therefore the greater was the luminosity. The efficiency of an incandescent mantle, as Mr. M'Pherson had endeavoured to show them, was almost entirely—though not altogether—a matter of flame temperature; it was a very great consideration to obtain the highest possible flame temperature. It was important that there should be a proper and efficient mixture of air with the gas; and with the flat-flame burner this was not secured. The bunsen burner was very much more efficient than the flat flame, because the gas was completely burnt; and in high-pressure lighting a still greater efficiency was arrived at, because the gas used was still more completely burnt. The idea of high-pressure gas lighting was not so much to get pressure on the gas, but that the gas being supplied under pressure enabled more air to be sucked in, and thus the gas to be burnt more completely. The sole object of introducing air was to more thoroughly burn the gas. As the incandescent mantle was the thing that was going to help them in fighting the battle of progress, the question of flame became a most important one, which would well repay great study and investigation. As to the use of producer gas, he once saw a mantle lit up by blue water gas, and it gave a beautiful light. It was simply a matter of burning the gas properly. They could burn practically anything that had calorific power with an incandescent mantle. It seemed to him that the problem of the future was to produce a gas capable of giving a suitable flame for an incandescent mantle, and to burn it so as to get the best results. He was rather struck with references to the sizes of flame. What they must try to do was to reduce, if possible, the extent of the flame. Mr. M'Pherson said the smaller the flame the more efficient would be the lighting; and it occurred to him (the President) then how splendid it would be if they could add a supply of cheap oxygen to the flame. There would be a small flame, with a very high flame temperature. He personally looked forward to the time when they would not burn their gas altogether in air, but would have a supply of oxygen available to reinforce the air. It would be a great day for internal combustion motors, and for every other kind of combustion, when the liquefied air process for the production of oxygen was completed. It was now in its embryo stage; but combustion was only in its infancy. When they really did understand what took place in the burning and destruction of various hydrocarbons in coal gas and other substances, and understood how they could best be utilized for the production of flame and light and heat, they would make tremendous strides in lighting and combustion motors. The day that brought them a cheap supply of oxygen would be the brightest day conceivable for gas manufacture.

The HON. SECRETARY (Mr. J. Hewett, of Saltley) seconded.

Mr. M'PHERSON thanked the members for their kind vote, and then proceeded to reply to the discussion. He quite agreed with Mr. Tatam, who had simply followed the matter on a little more advanced lines than he (Mr. M'Pherson) had put before them. The Smithells tube was certainly a very beautiful arrangement; and many other things might be proved in the same way, of which they were at present ignorant. Of course, with the same consumption of gas a higher temperature was obtained from a bunsen than from a flat-flame burner. He was in accord with Mr. Smith when he said that under the high-pressure gas system, taking it generally, they had a large expense to contend with, and that it was very questionable whether it repaid them to put in a high-pressure installation when they could get such results as the self-inteusified system showed. Gas people might, perhaps, get their supply more constant, and give a higher pressure during the day; but, of course, there were difficulties in the way. As to the size of flames, there was no doubt that the smaller the area in which a certain amount of gas could be burnt in a certain time, the better it was. The whole secret of success with the incandescent burner, where high temperature was everything, was to concentrate the flame area in the very smallest space. Inverted gas-burners were undoubtedly very good indeed for many purposes; and for street lighting in clusters the Kern burner was admirable.

PURIFIER COVERS AND RAPID FASTENERS.

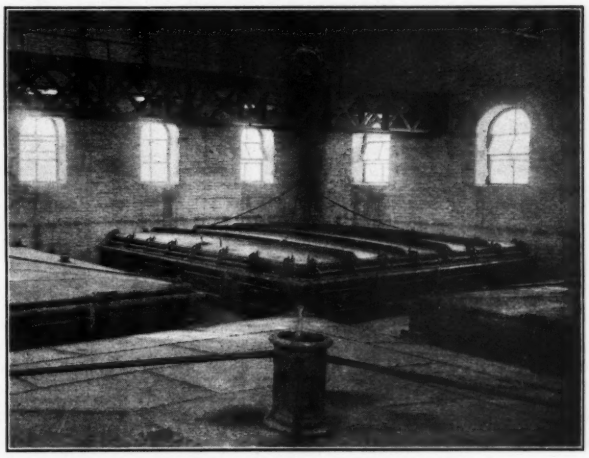
By THOMAS S. CLAPHAM, of Keighley.

When Mr. Henry Green, of Preston, conceived the idea of altering the form and construction of purifiers, and had the courage to put his convictions into practice, it would not be considered an epoch in the history of engineering; yet, to use the words recently published as being expressed by a prominent gas-works engineer and manager, "No greater revolution in the construction of purifiers has ever been introduced."

To say the least, it was a bold departure; and if the invention had not the essentials which go to make what is termed a great discovery, it did contain a principle—"Economy"—which is of the highest importance in commercial enterprise. The first cost by Green's method is materially lessened, through dispensing with large cumberous covers and costly lifting apparatus; and more floor-space in the house is utilized by the purifiers themselves. There is also a reduction in the cost of maintenance, owing to the longer life of the covers.

Until recently this new form of purifier was known as "Green's type," but lately it has often been referred to as "luteless" and "dry-lute," as opposed to the old form of water-lute. Like all other departures from orthodox lines, "Green's type" of purifier was subject to much criticism; but eventually the idea caught on; and makers of purifiers realized that the new method had come to stay. To-day the old form of water-luted purifiers is rarely specified or even asked for.

In many of the purifiers first constructed on this principle, it was found difficult to make a really satisfactory joint or dry-lute between the steel-cover and the cast-iron plates forming the floor or deck—sometimes termed the gangway; and as the ultimate



Showing the Conversion of a 20-Feet Square Water-Lute Box into a Dry-Lute Purifier.

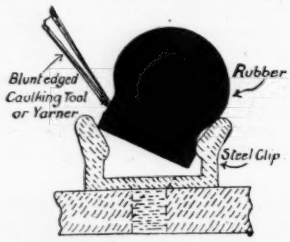
acceptance or rejection of the new method depended largely—indeed almost solely—upon a satisfactory solution of this difficulty, many devices were soon introduced. The writer was first brought to face the problem when battling for some weeks with a set of dry-lute purifier covers which had been built to specification, but refused for some time to satisfactorily stand the test required. The deck-plates were made with a machined facing-strip around the openings to the boxes; and in this machined strip were fixed stud bolts. The covers to the openings were flat, with an angle-iron frame on the underside; and to the latter were cemented strips of india-rubber $\frac{3}{16}$ inch thick—the covers being bored with holes for the reception of the stud-bolts. This primitive arrangement caused the contractors much anxiety and loss; and, undoubtedly, the manager of the works would have a continued share of trouble afterwards. The stud-bolts in some cases unscrewed from their position as the nuts were undone. Every nut had to be removed and placed on one side; and more likely than not some of them were missing when the cover had to be replaced and screwed up again. The uneven pressure on the angle-iron of the cover, through the bolts having to be tightened up separately, caused the rubber to be squeezed unequally; and, as a consequence, when the cover was raised, the rubber hung in festoons or (as was often the case) dropped from the cover altogether. The stud-bolts were always in the way when filling the purifiers, and much more so when the men were replacing the cover and trying to get each of these innumerable pests into its respective hole. Indeed, it was simply trying to apply the method adopted through the ages for making a flanged steam-pipe joint, which is only expected to be rarely, if ever undone, with the additional disadvantage that while a steam-pipe joint has two faced flanges, the purifier lute had only one machined face—that on the box, the angle-iron being in the rough.

These difficulties and unsatisfactory results lead to the invention of the "New Century" form of gas-works purifier cover, with

the "Eclipse" rubber joint, a cast-iron curb round the openings to the boxes, and automatic fastenings. Of the four improvements named, perhaps the chief is the rubber pad, inasmuch as a form in section was introduced which far superseded the thin flat-like washer which had so little power in itself to take up the unevenness in the two faces of the lute; while the new form has sufficient body and is backed up with a store of elasticity which meets all contingencies besides drawing itself back from the face as the pressure of the fasteners is taken off.

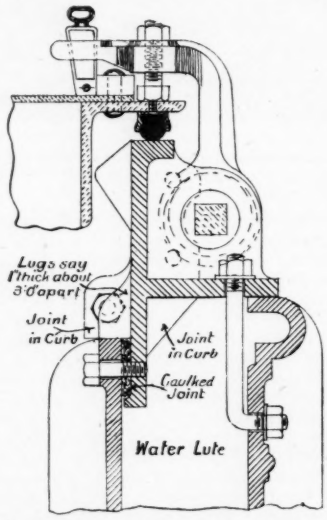
[Mr. Clapham proceeds to describe in detail the construction of the "New Century" cover—see "JOURNAL" for Nov. 26, 1901, p. 1386—and then deals with the "Eclipse" rubber joint and holding-down apparatus. In view of the fact that this latter arrangement was fully illustrated in the "JOURNAL" so recently as Nov. 1, 1904, p. 328, it is not necessary to give this part of the author's article.]

The three objects named having been attained, it was felt that the improvement would not be complete unless a rapid means of fastening and unfastening the covers to the openings were devised. To quote the words of the engineer before named: "The only drawback to the use of Green's type of purifier has been the increased time taken, and consequent increased cost of labour, in removing the number of bolts required to secure the small covers in position; and this has been completely overcome by an ingenious invention of Messrs. Clapham Bros., of Keighley.



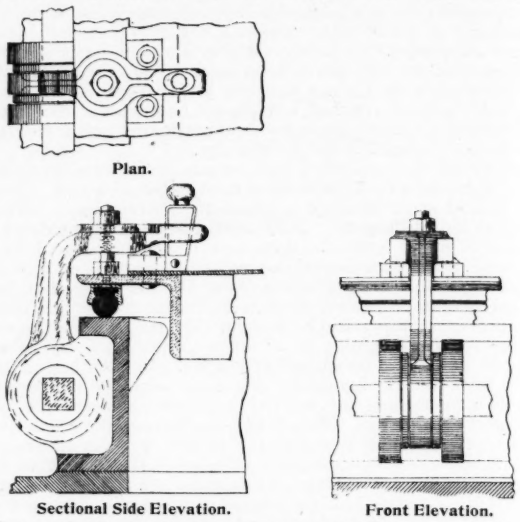
Method of Fixing "Eclipse" Rubber in Steel Clip.

In carrying out this idea, two essential features had to be kept in mind—viz., simplicity of mechanism and little cost. The inventor succeeded in meeting both these requirements by casting, on the curb, brackets in pairs, from about 2 to 3 ft. apart, which stiffen the curb and form bearers for a shaft. Each of the brackets is bored to admit a turned collar, in which is a square steel shaft. The shaft runs the full length of each side of the cast-iron frame or curb, and passes through the collars fitted into the brackets. The shaft being square, gives greater strength; it avoids the cost of keying the eccentric discs; and it allows the operator to turn the shaft at any place round the cover. Between each pair of



Water-Lute Purifier fitted with "Eclipse" Rubber Joint and Rapid Automatic Fasteners.

collars is a turned eccentric, with a square hole, through which the shaft passes, and a swan-head clutch, bored to suit the disc, is placed on it. The square shaft being turned with a powerful jaw-spanner, acts upon all the eccentrics on one side simultaneously—drawing down the clutches upon the top of the cover, and firmly pressing down the rubber joint. The direction of the shaft being reversed, the cover is liberated and ready for lifting. Provision is made at the crown of the swan-head for adjusting the clutches when required. If desired, the whole of the four shafts may be operated at one and the same time by fitting bevel-gearing at each corner; or the shafts may be mounted on the covers instead of on the cast-iron curbs. The former, however, entails increased cost, and the latter increased weight to the covers. By this system a great saving of time is effected; longer life to the rubber is secured; and uniformity of pressure on the fasteners is obtained. To this invention, Mr. Milbourne, of Messrs. C. & W. Walker, has added to the eccentric disc and strap a tooth or projection, and a stop or its equivalent so as to



Plan. **Sectional Side Elevation.** **Front Elevation.**

Dry Lute Purifier fitted with Angle Frame Flat Cover, with "Eclipse" Rubber Joint and Rapid Automatic Fasteners.

move the clutches clear of the flanges. This modification was described in the "JOURNAL" for Jan. 23, pp. 224-25.

Whatever may have been done by engineers and contractors to improve on the original design of this form of purifier, the fact remains that the idea first originated with Mr. Green; and those of us who have followed—it may be at a considerable distance—in his wake, are satisfied if our efforts by pen or production have in any way assisted to complete the idea which he conceived.

MANCHESTER JUNIOR GAS ASSOCIATION.

The Annual Dinner of the Association was held at the Exchange Hotel, Manchester, on Saturday; there being about fifty members and visitors present, including one or two members of the Senior Association. At a Smoking Concert held after the dinner, intervals were allowed for social intercourse.

After the Loyal Toast had been proposed by the President (Mr. J. E. Dudley), Mr. J. Garlick (the Treasurer) gave the health of the President. He said that, under Mr. Dudley's presidency, they had received some good advice, and had also increased their roll very considerably; there now being 108 members.

Mr. Dudley, in responding, said he had the work of the Association at heart.

Mr. Halliwell proposed "Our Guests;" and

Mr. S. Glover, of St. Helens, in responding, said he had received from the Secretary a very cordial invitation to join them that evening, for which he thanked them heartily. He remarked that there were four sorts of men to be dealt with. They had been described as follows: He who knows not, and knows not that he knows not, is a fool; he who knows not and knows that he knows not, needs help; he who knows and knows not that he knows, is asleep, and needs to be awakened; and he who knows and knows that he knows, is a leader. These were the sort of men to be found before them every day. He wished them very great success in their careers.

The Secretary said he had received a letter from Mr. J. W. Morrison who had been unable to be present, and who wished the Association every success. He would have attended had it been possible, in addition to Mr. Sutcliffe, who represented the Yorkshire Association.

Mr. Ginman proposed "Kindred Associations." He said the Junior Gas Associations had come to stay; the total membership of them being 470.

Mr. E. Allen, of Liverpool, in responding to the toast, said the Junior Associations of Gas Managers had a very great influence upon the industry.

Mr. Duxbury proposed the health of the Junior Gas Association; urging upon the members to do all they could to train themselves. Mr. Dudley responded.

The concert was contributed to by members of the Association.

Fiddes-Aldridge Machine-Stoker at Liverpool.

We learn that the Fiddes-Aldridge machine-stoker in use at the Wavertree works of the Liverpool United Gaslight Company, which was described in the "JOURNAL" for Jan. 30 (p. 274), has now been purchased by the Company, and that an order has also been given for a similar machine to be supplied at the Eccles Street works.

SOME THOUGHTS ON CONDENSATION.

By James S. M'Ilhenny, of Washington (D.C.).

[A Paper read before the American Gaslight Association.]

In dealing with the subject of gas condensation, I prefer to consider it as a whole—that is, the treatment to which gas should be subjected from the point of generation to the point of consumption, excepting only the chemical reactions for the removal of sulphur compounds, commonly called purification. This subject is of great interest, and I will emphasize my belief that, apart from the necessity of at all times being able to furnish the consumer with gas, no other feature of the gas business is of more importance than a thorough understanding and application of it, and nothing else will as quickly bring credit to the management of a company. Much has been written upon the subject, and many valuable laboratory experiments have been made. But, unfortunately, this work has not been comprehensive, usually being directed to some special feature; so that thorough understanding is lacking, and there is little tendency to change from old methods. Other features of the business have received great attention and been developed in minute detail; but condensation seems to have been neglected, or else in practice is treated in such a perfunctory way as to make the results obtained of little value, and at times even worse than useless.

Comparisons of results at different works are often misleading, as it is impossible in all cases to obtain perfect conditions for such observations, owing to the varying circumstances in which gas is manufactured—such as difference in candle power, weather, quality of coal or oil used, and the general construction of the manufacturing plant. This difficulty is more apparent in condensation than any other feature of gas manufacture; and it affords some excuse for the evident lack of exact information upon this important subject.

While these varying conditions exist, there is no reason why gas should not be subjected to such treatment at the works as would ensure its delivery throughout the distributing system without serious change of character or causing any trouble from deposits. Changes in temperature would affect gas after leaving the holder. But we have in hand enough control of the situation within the works to approximate such treatment of the gas as it is likely to meet throughout its course of distribution; and it is my belief that cause for complaint, not of a mechanical nature, can be greatly lessened by care in the manufacturing department.

The two great purposes for which condensation should be studied are, first, the removal of tar and heavy hydrocarbon oils which are certain to be precipitated from the gas at lower temperatures than that of generation; and, secondly, treatment of gas which will ensure its delivery throughout the distributing system without serious change. While both of these are important from a money point of view, they have separate bearings on the two great divisions of the gas business—the first influencing good and economical manufacturing results, and the second affecting the cost of distribution, and to a large extent influencing the intimate relations between the consumer and the company. Good results obtained in the first instance would secure credit to those charged with the manufacture of gas; and such results in the second instance would give pleasure and comfort to the consumer, would increase the friendly relations between them, and thus indirectly reflect credit upon the manufacturing management. No matter how careful or how thorough the distribution and complaint department of a company is organized and managed, it is utterly powerless to cope with the cause of complaints, or to obviate the friction with consumers which is certain to arise; and their work yields but indifferent results unless the management of the manufacturing department has performed its work well.

As an outgrowth of practice, certain forms of condensing apparatus have been developed, and from custom have been accepted as standards. Text-books variously place the proportion of cooling surface to rated capacity; but certain rules have been accepted governing this relative proportion as being the standards in construction work; no effort being made to adjust and proportion the apparatus to suit the conditions of gas manufacture. The fault of this is apparent when we consider the varying conditions of gas manufacture.

Coal gas and water gas, while possessing some similarity, differ in their physical and chemical nature, and gas generated under varying conditions does not have the same formation. For instance, coal gas generated and subjected to high temperatures would contain more naphthalene, owing to the benzol being broken up into its constituents; while that generated at a moderate temperature would contain more benzol, and the tars would be different in character and require different treatment in condensation. Yet we find the same apparatus, both as to type and proportion, designed for all these conditions. This may to some extent offer an explanation why naphthalene troubles occur in one works and not in another; the apparatus evidently not being designed in one case to suit the conditions, and in the other proving satisfactory.

In the location of apparatus, it is often the case that convenience controls the selection of the site; no thought being given to the relative positions of the other apparatus or design to accomplish a specific purpose. To get a better idea of the subject, it would be well to take it up at the point of generation, and follow it by stages throughout the system.

In coal-gas manufacture, the greater portion of the tar is deposited early, due to the rapid reduction of temperature in passing through the stand-pipes and by contact with water in the hydraulic main. In the early days, some effort was made to control this sudden deposit. But such efforts met with poor success, and it has now come to be considered as part of the generating system, and to be studied from this point of view. While I pass over this part of condensation briefly, I do not by any means regard it as unimportant, or as having been fully developed. Until, however, there is a better understanding of the proportion of the apparatus to the work required, but little improvement is likely to be found.

Primary Condensation.—Two forms of apparatus are in use for this purpose—the older and more popular being the erection along the walls of the retort-house, or at other convenient points, of a long line of pipes connecting the hydraulic main with the exhauster, and the other being of the multitubular pattern. Some difference of opinion exists as to the value of this primary condensation; and as reports of results obtained are so conflicting, the question still remains to be settled.

At the West Station works of the Washington Gas Company, there is connecting the hydraulic main with the exhauster a line of pipe about 1000 feet long, part of which is exposed and part underground. During very cold weather, the temperature of the gas in this main is often reduced as low as 85° at the inlet of the exhauster; and at such times there is some difficulty in maintaining good candle power. Contrary to expectation, there is little deposit of tar in this main. Some water is found, but the tar continues on, even at low temperatures, until it passes through the exhauster into the pressure side; the deposit there being very rapid. This would seem to prove that an absorption of illuminants by tar took place after the gas had been sufficiently cooled; but as the gas was under a slight vacuum, and no frictional surface interposed, the deposit did not take place until the gas reached the exhauster or was put under pressure. Doubtless the exhauster assisted in the deposit, as a considerable quantity of tar was noticed at this point.

Scrubbing.—There is some confusion of ideas as to what class of apparatus properly comes under this head. In water-gas plants, all appliances designed for the removal of tarry matter by frictional contact, either with or without the aid of water, are usually termed scrubbers; while in coal-gas works, the appliances classed under this head are generally understood as being for the purpose of removing ammonia—those which remove tar being classed as tar-extractors. For convenience, I prefer to consider as scrubbers all appliances having for their object the removal of tarry matter by frictional contact with some solid body, either with or without the aid of water.

Many types of apparatus have been designed for this purpose, such as vessels fitted with perforated plates, or filled with pieces of wood, coke, wooden cubes, or shavings; the object being the removal of the tar and entrained moisture by direct frictional contact with a solid body. But occasionally we meet with some form of apparatus designed for the removal of tar, ammonia, sulphuretted hydrogen, and carbonic acid, and the enrichment of the gas; the effect being that no result is apt to be satisfactory. Of those most in use, the shaving scrubbers and perforated plate types seem to give the greatest satisfaction. No matter what form or type is selected, it is certainly necessary to use something of this character for the removal of the light tars, as condensation alone will not do it, even though very low temperatures may be reached.

Any objection to the use of scrubbers is probably due to too much being expected of them. Usually the whole process of tar removal is attempted in one piece of apparatus; and to accomplish this it is designed as a general catch-all, independent of the condition of the gas at that point. There is also a wide variety of opinion as to the point at which it should be located—one man saying he preferred to place it at the inlet of his cooling apparatus, as it would reduce the candle power if put on the other end; another, that he preferred to locate it at the outlet of his cooling apparatus, because it would stop up if placed at the inlet; while a third, upon being questioned as to why the apparatus was fixed at a certain point, said that this was the easiest place to put it. It would be interesting to know the exact conditions surrounding such cases.

Any loss of candle power due to the actual removal of tars and contained illuminants in passing through a scrubbing apparatus cannot be directly chargeable to it; but it is a serious question if harm is not often done in the treatment of gas to permit of this sudden removal of tars in a single apparatus. In order to arrive at a fair conclusion, therefore, it would be necessary to consider the treatment the gas has undergone previous to reaching it.

Should the apparatus be placed immediately following the exhauster, it would have to deal only with the tars and condensed moisture that would be precipitated at high temperatures. It is then not likely that any serious harm could be done at this point; but, on the other hand, the work of removal of tars would only be partially completed. Those that would be precipitated below this temperature down to the final point of cooling would pass forward only to be deposited farther along in the system; and as no frictional surface is interposed, they would continue with the gas at such temperatures as would cause absorption of illuminants by them. The loss of candle power in this case, while not being apparent at the apparatus, is indirectly due to it. On the other hand, where this apparatus is located at the outlet of the con-

densers, the loss is also due to the long-continued contact of the gas with tar at temperatures that would permit re-absorption of illuminants which would finally be removed with it.

Condensing or Cooling.—For this purpose two forms of apparatus are in use; the older being the air-condenser, consisting of a continuous coil of pipe exposed to the atmosphere. This type of apparatus possesses the advantage of a reduction in temperature and at the same time some frictional scrubbing due to the contact of gas with the surface of the pipes; thus removing such tars as may be condensed at each lessening temperature. But the disadvantages of lack of control, ground space occupied, and large first cost have gradually led to its abandonment, and the substitution of the more modern type of multitubular condenser. This condenser possesses the advantages of better control, occupies little space, and is of low first cost; but it has the great disadvantages of little frictional contact during condensation, and extreme rapidity of reduction in temperature. It is not reasonable to suppose that gas can be reduced in temperature so suddenly without some harm resulting; and the swift travel of gas through the apparatus does not really permit the matter condensed out to be deposited in the apparatus—the result being that it is carried forward to some inconvenient place in the system, and causes trouble there.

Ammonia Scrubbing.—All appliances designed for this purpose have the general object of removing ammonia by bringing gas into intimate contact with water; and it is not likely that any method for removing ammonia other than this will soon be adopted. It only concerns condensation in that it offers another point for the gas to become thoroughly saturated with aqueous vapour; and as this apparatus is not usually followed by any frictional scrubbing, the temperature there would control the amount of moisture carried forward in the gas.

From this brief description of the condensing apparatus in general use, it will be seen that each possesses some merit, but that none is perfect. Some gas-works have only a portion of the plant here described; few are so fortunate as to have it all. The usual practice is to reduce the temperature to a desired point, such scrubbing being done as convenience will permit; and then the gas continues its course throughout the subsequent portion of the system without further attention. While the different conditions under which gas is manufactured would prevent the making of fixed rules in regard to the details of condensation, there is no reason why a general scheme cannot be adopted which would embrace the good features of the appliances in use, and largely remedy their defects. To successfully accomplish this, it will be necessary to devise some plan by which the gas can at all times be kept under perfect control both for cooling and frictional scrubbing. This can only be done by dividing condensation into a series of stages, each stage of cooling to be followed immediately by a stage of frictional scrubbing, and this process to continue throughout the entire system.

After leaving the hydraulic main of a coal-gas works, or the seal-box of a water-gas apparatus, gas is at a temperature of from 120° to 200° Fahr., and contains much matter in vapour form which should be removed before the final point of cooling is reached. At each stage of a reduction in temperature, a portion of this is changed from vapour to liquid—the change continuing throughout the process. In the early stages of temperature reduction, the condensed matter consists of heavy tars and water, and but few illuminants; and at each succeeding stage the condensed matter would differ from that of the preceding. To reduce this temperature by one action, and remove the condensed matter in one mass, cannot but be hurtful; while to allow the condensed matter to continue on until precipitated by gravity, or by scrubbing at the final point of cooling, would allow the tars full opportunity to re-absorb illuminants.

As the character of the gas and condensed matter would vary at each stage, it would be necessary, in order to have perfect control, to construct such apparatus in series, and proportion each stage of both cooling and scrubbing to the work required at this point. For instance, in the first stage for the condensing of heavy tars, but a small reduction in temperature would be necessary; and for their subsequent removal the frictional contact should be at slow speed and a soft impingement, so that the proportions of this section of apparatus would be a small area for cooling and a large one for scrubbing—a large area causing a slower speed in the scrubber, and permitting the use of large perforations in the frictional body. In the following sections of the apparatus, these areas, would progress inversely with gradually increasing condensing area and decreasing scrubbing area; the result being a decreasing speed in the condenser with increasing condensing area, and an increasing speed in the scrubber with decreasing size of perforations. The character of the gas to be treated would determine to some extent the regulation of these proportions; and observations made at the drip-pots would be of great assistance in guiding this adjustment.

The advantages of divisional condensation are, first, perfect control of the temperature during each stage of the cooling (this feature alone would justify any reasonable attempt in successful attainment); secondly, the ease of adjustment of scrubbing areas to suit the conditions of gas manufacture, and to so proportion them as to fit the needs of the case, no matter what may be the character of the gas under treatment. This value cannot be over-estimated, for upon the effects of proper scrubbing depend to a large extent the results obtained. Writers on the subject of condensation lay stress upon the necessity for the separation of the gas and the tar before reaching a temperature that would permit the re-absorption of illuminants by tar—the danger point being placed between 90° and 100°. Any association below this temperature is accepted as hurtful to the gas. On the other hand, tars condensed at the early stages contain nothing that there is a possibility of the gas again taking up to its advantage; so that we can plausibly assume that their removal at the end of each stage of cooling is a distinct gain, and, further, by removing them we add to the condensing power of the plant, because the tars would, if not removed, coat the condensing surfaces, and so lessen their capacity. Then, thirdly, divisional condensation would maintain the candle power, as the removal of the tars at each stage would prevent the possibility of any re-absorption of illuminants; while the slow condensing feature would permit of the full value of the illuminants being held in the gas. Fourthly, naphthalene troubles in the works could not occur; for, by the removal of the condensed matter at each stage of cooling, and by proportioning the speed of scrubbing and frictional contact to suit the removal at each stage, whatever naphthalene the tars absorbed would be removed in a fluid state; and should this divisional condensation be carried throughout the system, it would remove all aqueous vapour held above its temperature tension, and not permit any deposit of this sort at inconvenient points.

At first thought, it would seem that such a scheme as that outlined would be impossible, from excessive first cost or the cost of the attention necessary to operate it. This, in reality, would not be the case. As to the cooling feature alone, no additional cost would be added. To reduce a unit of gas from the temperature of generation to that which it is ultimately intended to reach requires the extraction of a certain number of heat units and a fixed ratio of cooling area. It does not matter whether this area is in one apparatus or in many, so long as the proportion of surface contact is maintained. In the scrubbing feature, some additional expense would be added, and also in connections and details of construction. As to the cost of operation, it would not require any additional expense. Perhaps some more attention would be necessary, but even then the apparatus could be so arranged as to reduce it to a minimum. Admitting that there would be no additional expense for installation and attention, it should not be considered as an argument against the adoption of anything of merit. In other details of gas manufacture, the limit of extravagance is often reached without regret where mere fractional savings are made; and so in this feature, where the possibilities of improving conditions are so great, we would be justified in large expenditures in the hope alone of improving conditions.

Some years ago, at the West Station works at Washington, a great deal of trouble arose from naphthalene deposits, both in the works and in the distributing system; and at sudden changes in the weather the matter became extremely serious. Owing to the rapid increase in gas consumption, all the condensing and scrubbing apparatus had become too small; the main reliance being two multitubular condensers which had been recently added. These condensers were of ample size to reduce the gas to any temperature that was desired; but as they were not followed by any frictional scrubbing, little could be accomplished with them to lessen the trouble. Fortunately, an air-condenser had been ordered; but, owing to pressure of work, it had not been erected. On taking charge of the works, I had this put up as early as possible; the gas being passed through the air-condenser, reducing the temperature to about 110°, and then through the multitubulars, reducing it to 60°. Conditions at once improved; but occasional stoppages continued in the works, and with each change of temperature there would arise some trouble with the services.

Soon after this, an entirely new plant of the modern water-gas type, with scrubbers and condensers attached, was installed, and a large relief holder put in service. The gas was then passed through the scrubbers and condensers of the water-gas set into the relief holder, and exhausted from it through the air-condenser and multitubular condenser, as was previously done. As the connections throughout the works were of considerable length, they afforded some frictional contact. This arrangement immediately proved more satisfactory—not a naphthalene stoppage having occurred in the works since, nor is there any appearance of it now. Conditions in the street department became so much better that we had come to regard the problem as being solved. However, at extreme changes of temperature occasional naphthalene stoppages continued to occur in exposed services. The erection of a new storage holder assisted in relieving this. The holder was some distance from the manufacturing department; and from the outlet of the station meter to the inlet of the holder there was a line of main about 1500 feet long. This pipe was laid on a grade, allowing the water to drain back toward the works. The effect of this long line of main was to remove from the gas much moisture that had been condensed out and not precipitated in the works. The general scheme of connection afforded an opportunity of testing the principle of divisional condensation—the cooling feature being under control; and while the frictional contact was not ample, or subject to adjustment, it was sufficient to assist materially in solving the problem.

The first scrubbers and condensers—which I will call the primary ones—were in tandem; gas passing through them in order. A temperature of 120° Fahr., or as near as possible to it, was maintained at the outlet of this system. The temperature in the relief holder changed but little; often not more than 5° being noticed. An average reduction of about 20° took place in the air-condenser. These condensers being housed, it was possible to

maintain some control of them. The secondary condensers were in a pair, and a temperature of 60° was maintained at the outlet —a reduction of about 40° in this apparatus.

I do not wish to be understood as meaning that our conditions are perfect, or that our system fully represents the proper idea of divisional condensation, as the proportional features of cooling are not perfect; and in scrubbing, the chief dependence is on the excessive length of main connecting the apparatus. The best results cannot be brought about in this way, but it is a step in the right direction; and the results obtained give encouragement to the belief that, with the principles of provisional condensation perfectly carried out, troublesome stoppages could be entirely obviated, and the maximum candle power retained in the gas.

While the careful treatment of the gas in the works for the removal of condensable matter with the least loss of illuminants is important, it is of equal importance to consider the effect of condensation in the distributing system. When we remember that gas from the point of generation is saturated with water vapour, and is being constantly brought in contact with water, even after passing the ordinary forms of cooling and scrubbing apparatus, as in the ammonia scrubber, purifier, and station meter, we can safely assume that its saturation is satisfied at the temperature at which it enters the storage holder; and being there stored in contact with water, another opportunity is offered for absorbing it. The ill-effects of this contained aqueous vapour on the gas, influencing as it does troublesome deposits, has long been recognized, and the early writers have pointed out the advantages of dehydrating gas; but only recently has the matter been given the serious attention that its importance demands.

The three great troubles directly traceable to an excessive amount of aqueous vapour are frozen services, liquid in the pipes and meters, and naphthalene deposits. Of the first two, little can be added to what has already been written upon the subject, as it is self-evident that with a gas freed from moisture these troubles could not occur; and it only remains to be determined what means, and what limit of expense, are necessary to accomplish this object. Of the third, while it is generally accepted as true that naphthalene is precipitated coincidently with the precipitation of water, and that by thoroughly drying the gas this deposit will not occur, even at extremely low temperatures, it unfortunately has not been made perfectly clear how this occurs. As naphthalene is an anhydrous crystal, changing into the crystal directly from the gas, and as it is not solvent in water, there can be no affinity between them; so that the precipitation must be mechanical. A reasonable deduction would be that the naphthalene crystals are present in the gas in microscopic size, and, owing to their light gravity, float along in this form in currents of gas. Should there be no aqueous vapour present, or should it be permanent, no precipitation could occur; but as it is condensed out, it is for a time carried along, until, forming into vesicles, it falls by gravity. In the course of this formation of vesicles, naphthalene crystals are incorporated in them, assisting in their formation mechanically, and consequently are precipitated with the water. No matter what theory proves to be the correct one, if it be fully determined that water vapour assists in the deposit of naphthalene, the proving of the theory would only be of interest to the scientist. Our interest is to determine what degree of dryness is necessary to accomplish this object, and how it can be done in a practical and economical manner.

As the gas, after leaving the storage holder, is subject to the influence of a wide range of temperature (often upwards of 100° in annual changes) over which no control is possible, any device for controlling the condition of the gas before its final entrance into the distributing system must be placed at the outlet of the holder. As there is a natural hesitancy to assume any risk of a possible interruption to the supply of gas, no device is likely to meet with favour that does not ensure against such interruptions. No process of drying by absorption is uniform in action, and there is a possibility of accidental interruption in the gas supply; so that our reliance must be on some form of condensing apparatus.

The variation of temperature surrounding gas-mains is not great throughout the year; and if a uniform temperature were maintained at the outlet of the holder, the effect would be reduced to a minimum. Under the present conditions of gas delivery, the variation of the temperature of gas in the holder has more influence in causing it in the mains than the outside influence of the earth surrounding them; and should it be possible to maintain a uniform temperature within the mains, there would be little trouble from stoppages, even in exposed services, as the heat contained would hardly be lowered sufficiently, in the short time of the passage of the gas through the service, to cause much precipitation of moisture, and the continual flow of gas would maintain such temperature as to prevent any freezing.

In order to keep up a uniform temperature at all times at the inlet of the distributing system, it would be necessary to have some medium which would be of one temperature throughout the year, and be independent of weather conditions. For this purpose, I suggest the sinking of wells in the earth to a depth that would ensure uniform temperature; and by passing water in a coil down these wells, we should have a medium under perfect control. Then by the use of the multitubular condenser, with attending frictional contact, the gas could be maintained at a permanent temperature, and all moisture possible be removed by frictional scrubbing. It would be necessary, of course, to have the capacity of such apparatus equal to the greatest hourly output of the year; but as the water would be of uniform temperature, the apparatus would not need nice adjustment, and would require practically no attention. The water being of one heat, an excess of it would do no harm. It may be urged that the cost of installation and attention would not be warranted by the benefit obtained. Apart from the satisfaction which good service would give, let us consider the possibilities of saving. In the large cities, the average cost of attending to each complaint is about 60 c. This does not mean that a complaint man could not go out and free a single service for less than this amount; but for the total maintenance of such a department it fully equals this average. Adding to this the loss of prestige and possible loss of consumers, and also, as is often the case, the sacrifice in manufacturing results, with the hope of obviating the trouble at this point, it totals, in the course of a year, to such an amount as would justify liberal expenditure at the works so as to prevent the trouble.

In conclusion, it may be added that while many difficulties would be encountered in the endeavour to solve this interesting problem, it is not impossible. It rarely happens that any one man is so fortunate as to have an opportunity to investigate the subject in all its details; but by proceeding along defined lines, the work of many may be concentrated, and ultimate success attained.

Discussion.

Mr. E. H. Earnshaw (Philadelphia) thought Mr. M'Ilhenny had pointed out very clearly the common lack of attention paid to the important subject of condensation; and he believed all would agree with him that it was one that would well repay any care and study devoted to it. He was much interested in the account of the condensation system at the West Station works; but he considered Mr. M'Ilhenny had not given sufficient credit to the part played by the relief holder in securing good results. It had long been generally known that the relief holder in water-gas manufacture was the most important part of the condensing apparatus, and he often wished to know what good result would be obtained by its use in connection with the condensation of coal gas. The necessity of employing a double set of exhausters had made it difficult to even experiment with the coal-gas relief holder scheme for coal gas; and engineers had used, as a somewhat inefficient substitute, large primary air condensers in which the rate of flow was checked and a great amount of tarry matter deposited, even though there might be a comparatively slight reduction in temperature. Experience had demonstrated that, as a tar-extractor for water gas, the relief holder was more efficient than any frictional apparatus placed immediately after the condensers. Some years ago, he conducted a series of experiments having in view the determination of the best method of removing tar from water gas; and in the course of them an apparatus was used in which the gas was passed through a series of perforated plates against inpingement surfaces, on the principle of the Pelouze and Audouin tar-extractor. With the apparatus located at the inlet to the purifiers, the temperature of the gas being from 105° to 110° Fahr., and using a sufficient number of perforated plates to completely remove the tar, it was found that the quantity of tar so removed was about half-a-gallon per 1000 cubic feet. At the inlet to the condensers (the temperature of the gas being 175° Fahr.) the quantity of tar removed was insignificant. With the apparatus located at the outlet of the condensers, the amount of tar was constant at different temperatures—about 0·12 gallon; the quantity of uncondensed tar decreasing with each reduction in temperature until at about 90° Fahr. the removal of the tar was reasonably complete. With the temperature at 110° Fahr. at the outlet of the condensers, the gas still contained not less than 0·2 gallon of tar per 1000; at this same temperature at the inlet to the purifiers, it was only 0·02 gallon—thus indicating the great value of the relief holder as a tar-extractor. Mr. M'Ilhenny had also touched upon the removal of naphthalene; but the conclusions he reached were at variance with theory and with such experience as he (Mr. Earnshaw) had had. With divisional or fractional condensation, the vapours were condensed approximately in the order of their vapour tensions; so that the tendency to naphthalene stoppages should be greatly increased by the early removal of the heavier vapours, as usually there was not enough tar with the same vapour tension as naphthalene to dissolve the deposited crystals, and prevent solid obstruction from forming in the cooler portions of the condensing apparatus. His experience had convinced him that this was the principal objection to an otherwise sound and desirable practice. For this reason, an apparatus for scrubbing the gas with an oil or a tar free from naphthalene should be included in the condensation scheme; the apparatus being placed at a point where the temperature of the gas was about 100° Fahr., as at this temperature the naphthalene could be removed without any loss of illuminating power. Mr. M'Ilhenny had assumed that naphthalene would not be deposited in the absence of water vapour. Some years ago, the presence of considerable quantities of naphthalene in the mains in the works with which he (Mr. Earnshaw) was then connected, led to his undertaking certain laboratory experiments with the view of ascertaining, first, whether illuminating gas reasonably free from naphthalene would pick up any already deposited in the mains, and whether naphthalene so picked up would be re-deposited on change of temperature; secondly, the influence of the presence of naphtha vapour in the gas; thirdly, the effect of temperature in both of these cases; lastly, whether the absence of water vapour would prevent or retard the deposition of naphthalene. In

these experiments, illuminating gas at a temperature of 90° Fahr., was passed over naphthalene maintained at the same temperature, and then suddenly cooled down to 45° Fahr.; and the amount of naphthalene picked up, and the extent to which it was re-deposited on cooling, were observed. In the same way, gas at 50° Fahr. was passed over naphthalene at a similar temperature, and then cooled, as before, to 45° Fahr. It was then charged with naphtha vapour to the amount of half-a-gallon of naphtha per 1000 feet, and the experiments repeated. In the next series, the gas was thoroughly dried by passing it through tubes filled with calcium chloride, and then over naphthalene at the high and low temperatures, both with and without naphtha vapour. Consideration of the results obtained led to the following conclusions: That illuminating gas will pick up naphthalene already in the mains, and that the amount so picked up will, to a great extent, be deposited again on a sudden lowering of the temperature; that the presence of naphtha vapour in the gas will not increase its power of picking up naphthalene already deposited, but will assist in preventing it from being re-deposited on a sudden lowering of the temperature; that, whether or not the gas be charged with naphtha vapour, the facility with which it will pick up naphthalene varies directly with, and is greatly influenced by, the temperature; and that thorough drying of the gas has no effect on the amount of naphthalene picked up or re-deposited, whether or not the gas is charged with naphtha vapour. This last conclusion was directly contrary to the idea almost universally entertained in regard to the effect of drying the gas on the deposition of naphthalene; but it simply went to show that the vapour of this substance was subject to the same laws, and was liable to deposition under the same conditions, as any other. The chief difference was that naphthalene passed directly from the gaseous to the solid state, while all other vapours found in illuminating gas condensed to a liquid. Friction promoted the condensation of naphthalene in precisely the same way that it promoted the condensation of tar; and hence the tendency to form accumulations in elbows and bends. For the reasons stated, it was clearly evident that condensation of water vapour would always accompany the deposition of naphthalene; but this was because the conditions favourable to the deposition were even more so to the condensation of water vapour, and not, as was usually supposed, because the water carried the naphthalene down with it.

Mr. ROLLIN NORRIS (Philadelphia) suggested that there was one thing which perhaps had better be put on record. Mr. M'Ilhenny said that probably the temperature of the ground surrounding the gas-mains did not vary very much at different seasons of the year; but such figures as he (Mr. Norris) had would indicate that, in the climate of his city, the range was from about 30° Fahr. in winter to about 80° Fahr. in summer.

Mr. T. D. MILLER (New Orleans) said he had been making some investigations on ground temperatures for the past eight months. The soil in New Orleans was saturated with water; and with the view of arriving at some conclusion in regard to naphthalene, he had a thermometer put in the ground in the autumn of 1904. He had not yet tabulated the results of the experiment; but the maximum change found from last winter, when the thermometer was below freezing-point, was that in the ground they found a temperature of 58° Fahr., and this summer [1905] an atmospheric temperature of 62° Fahr. This showed that one need not bother very much about change in ground temperature. His idea was that the foundation was laid in the summer for most of the naphthalene troubles that were found in the winter. The gas left the holder in the summer at a high temperature; and, striking the cool pipes in the ground, deposited naphthalene in them. In the winter time the gas went out cool, entered the warm pipes, and took up the naphthalene, carrying it along until a cool pipe was struck, where it was deposited. With this idea, he had made an effort at Dallas to be relieved of a trouble which had been serious in the previous winter, and worked against the deposit of naphthalene in their mains in the summer; and instead of having 2000 or 3000 complaints the next year, they had only 20. Carrying this out for two years, they had no trouble whatever with naphthalene in the winter time. Mr. Earnshaw, in his remarks, had very emphatically corroborated this theory. With regard to condensation in connection with high-pressure work, one winter they laid all their lines without any drips, and in a certain section at the lower end of the town, supplied almost exclusively by high-pressure gas, without any warning, they had complaints coming in respecting the Welsbach burners; and a little later on, others respecting the ordinary burners piled up. Investigation showed a deposit of tarry matter on the long-tube incandescent gas-burners; and on the short tubes, where the heat was high enough, a very good quality of black Japan. They cleaned the burners; but after they did this with a few lamps, they found they would clog up the next night. In one case an arc lamp was cleaned and watched; and it was only 6 minutes before it was stopped again. The complaint was general. They sent out a number of men, who found that the fittings were stopped up with the troublesome tarry deposit. He connected the trouble with naphthalene, and provided the men with a little pump, which they would use on the house and service pipes until they got clear gasoline. But in three or four days they had the same trouble. They put a wisp of cotton in a service-pipe in a house just cleaned out; but in three days the burners were stopped up. The cotton came out clean and clear, with not a stain on it; but they had discoloration on the Welsbach burners and in the tips of the Bray burners if it remained long enough. They then commenced work on their mains; and he thought the water gas was taking up the deposit of naphthalene and carrying it into the house-pipes. They found very heavy condensation indeed in both their high-pressure and their low-pressure mains; and they also noticed that in the heavy hours of the evening there was trouble in the governor, which showed that the condensation from the high-pressure main was going into the low-pressure one. It was carried along until it struck the fine orifices of the Welsbach burners, where it was acted on by the heat and turned into the tarry substance he had mentioned. They put in a light pipe at the station, and obtained several gallons of heavy oily deposit; and they were obliged to take it back to the works and burn it. To obviate this, they put in a larger condenser and a spacious pulsation tank with condenser tubes in it, and the trouble did not occur again. Though they used the light pipes, they did not get the heavy deposit again.

Mr. M'ILHENNY, replying upon the discussion, said he would answer only one point made by Mr. Earnshaw, who had evidently misunderstood the idea of the relief holder, which was of great advantage in the condensation of both water gas and coal gas; and they used it in both cases. He thought there were other means of removing the tar without considering the possibilities of re-absorption, and not being subject to the variation of height and temperature in the relief holder. With regard to the drying of gas by passing it through naphthalene, this again being deposited, it was a question as to what was the condition of the gas with which the experiment was made. Were the constituents of the gas which had the power of absorbing naphthalene fully satisfactory, or was the naphthalene picked up mechanically, as the speaker supposed? If picked up mechanically it would only be carried along in the same way, and would be deposited again by its own gravity. Mr. Norris had spoken of the range in temperature of pipes in Philadelphia. Evidently his figures were extreme ranges, as 23° Fahr. was the lowest and 80° Fahr. the highest; and even this was only a variation of 57°. Possibly, however, this condition would only last a few hours; while the variation surrounding the gasholder and the gas before entering the distribution system would amount to 100° or 120° Fahr.

ELECTROLYTIC ACTION AND GAS-MAINS.

The "American Gaslight Journal" for the 22nd ult. contained an article on the above subject specially prepared for that publication by Mr. W. H. Cole, of Newton (Mass.). The author had noticed the remarks on the paper read by Mr. H. L. Rice, of Aurora, at the last annual meeting of the American Gaslight Association, on "High-Pressure Gas Distribution of To-Day,"* and with respect to the portion of it dealing with the electrolytic destruction of gas-mains, it seemed to him that the average gas engineer had a somewhat confused idea of the flow of electricity along the paths presented to it, and also as to the responsibility of railway companies for damage done by stray currents. He therefore made the following observations on the subject.

Railway companies are probably morally bound to maintain, and indeed are financially interested in maintaining, a sufficient metallic return for their current to the source of power. They do not depend in the slightest degree upon the conductivity of the underground systems of pipes, be they water or gas, for the successful operation of their cars. They realize that the investment necessary to secure good bonding and return feeders pays well in the saving of coal and an improved service; and, as a general rule, they are able to declare, without contradiction, that the ground return installed by them is ample for the successful conduct of their business, whether or not there be pipe systems adjacent to their tracks. Wherever the responsibility may finally be placed, the probable duty of the gas or water distributor at present lies along lines of self-protection; and until the question is settled, he should use all means known to preserve his pipe system, and preserve it from ravages of electrolytic action.

Referring to the discussion as to the relative merits of bonding and insulating sections of pipe to prevent the inroads of electrolysis, I do not agree with Mr. Brownell and Professor Burgess in their emphatic condemnation of insulating joints, nor do I entirely disagree with the expressions made by different gentlemen as to the efficacy of a well-bonded pipe system, though I can conceive of conditions where bonding would be worse than useless.

Referring briefly to the fact that gas engineers are to a large extent somewhat hazy on the subject of electrical resistance and flow of current, and at times ready to accept as positive facts the opinions of alleged electrical experts, it may be as well to state that the flow of electricity through the earth and metallic conductors is proportional to the conductivity of the separate paths, and that difference of potential or electrical pressure is not in itself indicative of the amount of current flowing between the two points where the difference of potential is observed. It is generally understood at the present time, however, that damaging electrolytic action takes place only where the electric current leaves a metallic conductor and passes into a non-metallic conducting medium in the presence of moisture, which may or may not be of an acid or alkaline nature. The damage from

* See "JOURNAL," Vol. XCII., p. 679, and *ante*, p. 107.

purely galvanic action between dissimilar metals is not of much moment, except where the two or more metals are submerged in a fairly good conducting medium, such as sea water.

In considering the return paths for the trolley current, let us assume the parallel presence of bonded rails, gas and water mains, and "Mother Earth." The first two paths mentioned are metallic and of definite cross-sectional area, and of fairly definite resistance or conductivity. The third path—the earth—is very indefinite in cross-section, and likewise indefinite in conductivity. Comparing the relative resistances of equal cross-sectional areas of the three above-mentioned return paths, we find that the average resistance of the earth is very high; but, on the other hand, the cross-section of the earth return path may be so great that its resistance as a whole may be relatively small, and, barring streaks of high conductivity, the density of current per unit area of the soil will have a very low value.

From the above, I maintain, and I think I am borne out in my opinion by a number of qualified engineers, that pipe systems as a whole collect their electricity over a large negative area—that is to say, where pipes are negative to the rails—and discharge it to the trolley ground return in the positive area, which is generally more restricted, due to the fact that the power-house is permanently fixed, while the cars are running all over the track system. This restriction in positive area leads to a concentrated discharge which may be over such an area as to be a long time causing trouble, or it will—provided the earth in this positive area is of relatively high conductivity in streaks—discharge at points, causing the damage to be highly concentrated, which is shown by fairly well-defined holes eaten into pipes so damaged.

I further maintain that if restrictions are properly placed in pipe-lines so as to prevent the collection of this current in the negative district, there will substantially be no current to be discharged in the positive districts. Therefore, using insulating, or, to be more exact, high-resistance, joints with every length of pipe, prevents each section of pipe in the negative area from taking up its small increment of current, which, if there were no insulating joints, would be carried along the line, and added to the collection of all other sections of pipe in the negative area, finally leaving the pipe system in the positive area—doing damage which might or might not be distributed, and therefore take a greater or less time to become evident.

Inasmuch as the average difference of potential per 12 feet of track, even at heavy loads, is very small, it follows that a parallel length of pipe would not have a substantially greater difference; and as, as was pointed out in the discussion, the earth's resistance is very high per unit of area, this very small pressure existing at each point would not force any appreciable current around the insulated joint, and therefore no damage would result. Ample proof of this theory is found in the case of cast-iron mains made up with cement joints, which have a relatively low resistance, and may not be classed as insulating joints. Many miles of these cement-joined gas-mains have been in use for several years in a territory where a great deal of electric railroading is done.

Referring to the installation of insulating joints at North Adams (Mass.), where they were used approximately every 500 feet on a wrought-iron line, in this case the use of only one joint in 500 feet was an ill-advised absurdity, and would be comparable with the action of a railway company who bonded their rails every 500 feet and expected to get a return of high conductivity; for in one case resistance was aimed at with ten joints per mile of pipe line with a good conductor between, and in the other conductivity was wanted and expected with only ten bonds per mile, with resistance between at every rail joint. Such track bonding would be absurd, but no more so than the parallel case of pipe insulation referred to. The very fact that pipes are buried in the earth requires the free use of insulating joints to minimize the effects of conducting streaks, and to split up the difference of potential along the trolley return circuit so that the separate differences of potential will be so small as to be unable to force any appreciable current around a joint.

Assuming that the North Adams line has thirty insulated joints each side of the power-house, and that the maximum loss of voltage in the track return is 200 volts (which, by the way, would represent worse than poor practice), we have, dividing this 200 volts by thirty joints, an average potential of $6\frac{2}{3}$ volts available at each joint to force current around through the earth. Furthermore, the long length of undivided pipe between the joints presents a great area to the earth, and permits of current entering and leaving over comparatively large surfaces. This reduces very largely the resistance through earth around joints due to the greatly increased area of the earth path, and consequently defeats the very purpose for which the joints were introduced.

Now let us see what the conditions would have been had this line been laid with 12-feet lengths with an insulated joint at each length. Assuming that 200 volts were lost in the return path of the trolley as before, we have in 3 miles of pipe, or 1200 joints, a pressure averaging at each joint (200 ÷ 1200) $\frac{1}{6}$ volt. This insignificant pressure would, of course, act to force current around each joint; but while we have reduced the joint pressure, we have also added greatly to the earth resistance around the joint by cutting down the area of pipe between the joints, and consequently the cross section of the earth path around them.

Closing with a few words in regard to the efficiency of bonding pipes to each other and to the trolley rails, there is no doubt that, if properly installed and maintained, such bonding would be successful in some few cases; but, in my judgment, such action savours of cowardice, and, furthermore, establishes a bad precedent, which may have a bearing on the final placing of responsibility for electrolytic damage throughout the country. If you work in the other direction, and keep the current off your lines, you may at least know that you have attempted to save your property without admitting responsibility.

The Ventilating Value of Gas.

In the course of a letter to the "Manchester Guardian," dealing with certain criticisms which appeared in an editorial in that paper of his recent presidential address to the Manchester District Institution of Gas Engineers, Mr. J. H. Brearley, of Longwood, says, with regard to the ventilating value of gas: "My assertion, based upon actual tests taken, was that to claim electricity as being healthier than gas in any room where there is ventilation at all, is not only hollow but impertinent. Recently we have been going somewhat exhaustively into the testing of gas-fires; and in no single case have we found the air of the room to be changed less than twice in the hour. With gas-fires consuming as much as 40 cubic feet of gas per hour (which is ten times more than an incandescent gas-burner will consume) in a room of 2000 cubic feet capacity, the quantity of carbonic acid found in the air of the room was never more than 15 parts in 10,000 after the fire had been burning for five hours, with the door of the room closed and two persons inside the room the whole of the time. This is a condition that would never happen in practice; and the quantity of carbonic acid found is considerably higher, therefore, than would be obtained in practice, where doors are frequently opened. What the gas-fire will do the coal-fire will do—that is, change the air of the room at least twice within the hour. I did concede that where absolutely no ventilation was provided, electricity had an advantage. I also gave particulars of a test taken at Longwood, in which, after ten persons had been shut up in a room of only 1732 cubical feet capacity, with the door closed, no fireplace or chimney, but only one small outlet ventilator of 50 square inches, the increase in the quantity of carbonic acid per million at the end of the two hours, with two gas-lights also burning the whole of the time, was only 1196 volumes per million. With electricity, it was 1543 volumes per million increase; or a difference of 29 per cent. But the conditions of this test were such as would never be actually found in practice. The conclusion is obvious, therefore, that in any room with an open fireplace or any ventilation outlet, and in which persons spend a considerable portion of their time, as in residences, there will be found to be practically no difference between the quantity of carbonic acid in the atmosphere whether gas or electricity is the illuminant."

PARLIAMENTARY INTELLIGENCE.

PRIVATE BILLS (SESSION 1906).

HOUSE OF LORDS.

The following progress has been made with Bills:—

Bills presented and read the first time: Accrington District Gas and Water Board Bill, Bury Corporation Bill, Cumberland Electricity and Power Gas Bill, Fulwood Urban District Water Bill, Glamorgan and South Wales Water Bill, Llandrindod Wells Gas Bill, Newport Corporation Bill, Newtownards Urban District Council Bill, Wolstanton United Urban District Council Gas Bill.

Bills presented, read the first time, and referred to the Examiners: Crediton Lighting and Power Bill, Holyhead Water Bill, Kidderminster Gas Bill, Mirfield Gas Bill, North Sussex Gas and Water Bill, Portsmouth Water Bill, Truro Gas Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills read a second time and committed: Bacup Corporation Bill, Carlisle Corporation Bill, Kettering Water Bill, Kingston-upon-Hull Corporation Bill, Manchester Corporation Bill, Metropolitan Water Board Bill, New Mills Urban District Council Bill, Thornton Urban District Gas Bill, Todmorden Corporation Bill.

The following Bills have been formed into groups:—

GROUP A.—Ascot District Gas (Electric Lighting) Bill, Cardiff Gas Bill, Dowlais Gas Bill, Epsom and Ewell Gas Bill, Merthyr Tydfil Gas Bill, Rochester, Chatham, and Strood Gas Bill, Thornton Urban District Gas Bill, Uxbridge Gas Bill, Watford Gas Bill.

GROUP C.—Cheltenham Gas Bill, Derby Gas Bill, Gas Companies (Removal of Sulphur Restrictions) Bill, Southampton Gas Bill, Tottenham and Edmonton Gas Bill, Wandsworth and Putney Gas (Removal of Sulphur Restrictions) Bill.

GROUP D.—Heacham Water Bill, Mid-Oxfordshire Gas Bill, South Lincolnshire Water Bill.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by Correspondents.]

The Hydraulic Apparatus for Operating the Valves of the Coal-Measuring Chambers at Tottenham.

SIR,—In reading your very interesting description of the new retort-house at the Tottenham Gas-Works, appearing in the issue of the 13th of February, my attention is called to a paragraph (p. 414) reading as follows:—

These measuring chambers are fitted with the latest hydraulic apparatus for opening separately the slides. . . . This principle of operating the valves of measuring chambers has commended itself before to gas engineers; and it will be remembered that Mr. Herring in his Granton inclined retort-house adopted a somewhat similar method of working.

The exact meaning of the paragraph is not quite clear. Permit me therefore to state that the "principle of operating the valves of measuring chambers" referred to forms the subject of a British patent granted to myself in the year 1901, No. 26,143. It may also be interesting to note that, among other countries, the American patent is No. 706,940; and the German patent, No. 14,138. The granting to a British subject of either an American or a German patent is usually accepted as a secure title to origin, owing to the elaborate and complete system of search adopted in both countries.

I think it only fair to myself that this correction should be placed on record.

W. R. HERRING,
Edinburgh, March 1, 1906. Chief Engineer and Manager.

P.S.—The system referred to was illustrated and described in the "JOURNAL" for April 21 and May 5, 1903, as was also the method of discharging coal-waggons by means of hydraulic appliances sunk beneath the rails up-ending the waggon and discharging its contents through an end door.

Gas as a Means of Ventilation.

SIR,—I have read with much interest the Inaugural Address of the President of the Manchester District Institution of Gas Engineers, in the "JOURNAL" for Feb. 27.

The suggestion of the use of perforated ceiling rosettes (which he calls centre-pieces) for the purpose of ventilating rooms in private dwelling houses is a very admirable one, and, when the arrangement is properly installed, is as near perfection as possible. I have, during my business career, fitted a large number of rooms in this manner; and it is not, as he seems to fear, a "question of fad," but it is a fact of very great importance and utility.

The products of combustion will not, however, travel through the outside wall of the house—as appears to be illustrated in Diagram No. 2—but must be led into the chimney of the room; and they are then carried away by the up-draught, with the smoke of the grate.

Briefly described, the apparatus is as follows: 1. A hole in the ceiling, the larger the better; 2. A perforated ceiling rosette, to cover same; 3. A tin or zinc hopper, placed between the joists, to cover the hole in the ceiling; 4. A tube fixed between the joists from the hopper, flush with the interior face of the chimney.

It is advisable not to use a ventilating grid (as shown in the diagram), as I found in practise that such a grid frequently got out of order.

There are, of course, difficulties in this arrangement to be overcome. For instance, the joists may run across the line of the zinc flue-pipe (and the one that carries the hearth generally does); but they can be trimmed, or otherwise dealt with.

An objection may be raised that the smoke from the chimney might blow down the tube (it does not often do so, as a down-draught follows the line of least resistance); but if it does, it is not the fault of the apparatus, but the fault of the chimney, which *would smoke at times*—whether the apparatus were there or not. The best way to stop the down-draught in a chimney is to lengthen it by brickwork or a tall-boy (no cowl) as much as is necessary.

There is no occasion to provide for the inlet of fresh air to the room—the imperfect fitting of the doors and windows generally allows all that is necessary; but a Tobin tube may sometimes be of advantage.

One good example of the above may be of interest. It was in the house of a gentleman whose dining-room was over the stable, which had been built as an annexe to his house. The smell of the stable was very disagreeable; and I fitted it as above described, and effectually did away with the annoyance, in addition to perfectly ventilating the room.

I feel that every idea, which is in favour of the gas industry, should be well discussed; and that is my excuse for troubling you with this letter.

March 2, 1906. T. A. GREENE.

Purification Results at Chester and Stretford.

SIR,—Adverting to the report in your last issue of the discussion on "Purifier Grids," at the Manchester District Institution of Gas Engineers, and your editorial remarks thereon, may we (without venturing as manufacturers to use your columns for trade purposes) have your permission to say a few words on the subject, as otherwise it seems to us some wrong impressions may obtain undue currency.

The introduction by us into this country of new purifying methods has undoubtedly directed attention to the possibility of making better use of purifiers generally; and we are not surprised at the various efforts made to accomplish similar results to our own. Judging, however, by the figures stated by Mr. Kendrick in regard to the Stretford purifiers, the results there appear to fall a very long way short of what has been accomplished by our system at Chester, the figures relating to which have already been published in the "JOURNAL," and which have been fully maintained by numerous subsequent installations.

The following figures are tabulated from statistics published in the "JOURNAL":—

—	Tons Oxide in Box.	Summer Working. Gas Passed. Per Change.	Summer Working. Gas Passed. Per Ton.	Winter Working. Gas Passed. Per Change.	Winter Working. Gas Passed. Per Ton.
Chester, 24′ × 22′ × 5′3″ ("JOURNAL," Feb. 7 and May 16, 1905.) .	50½	55,895,000	1,106,831	29,024,000	574,732
Stretford, 20′ × 20′ × 5′ (JOURNAL," Nov. 28, 1905, Feb. 27, 1906.).	28	8,207,000	293,000	5,425,500	193,000

We feel it incumbent upon us to ask permission to make this statement, having regard to the large number of "Jäger" installations that have been put down upon our recommendation; and we cordially welcome your suggestion that research, on a proper scientific basis, should be made.

Our own experience is that the increased bulk of oxide must be accompanied by a substantial increase in contact-surface, if full efficiency is to be attained; and the only satisfactory means of providing this necessary increase is by the use of the conduits peculiar to the "Jäger" system.

To increase the contact-surface by admitting the gas at both top and bottom, or at a central chamber, is neither novel in principle nor satisfactory in result.

The results tabulated above somewhat coincide with our own experiences with purifiers in which the Jäger grids have been used without the conduits, but retaining the vertical flow; for then only partial improvement has been secured.

The question, therefore, becomes one of a slightly increased efficiency due to the additional bulk of material, or of a largely increased efficiency due not only to the additional bulk of material but also to slow-travel and large contact-area.

Millwall, E., March 3, 1906. SAML. CUTLER AND SONS.

Gas Mains and Electric Cables.

SIR,—Your attention will, no doubt, have been called to the report of "poisonous fumes causing six persons to be overcome at Upton Park through the ignition of the insulating matter upon the electric cable under the side-walk"—a faulty electric cable having led to dense smoke entering a house. At the end of the report in two London papers which I have seen to-day, there are two different garbled accounts of the information received from electrical engineers of "experience" attributing the cause to gas. I think it would be well, in the interests of the gas industry, if you were to take special care to get at the bottom of this, as there have been so many false charges made against gas supply authorities wherever there has been an electric cable fusing. They always associate it with a mysterious escape of gas at the same point, whereas I am quite convinced that in these cases they make their own explosive mixture, when it is an explosion—as they have in this case made their own poisonous fumes, while they always want to say that gas is at the bottom of it.

I think that this case may prove one of those where the disturbance caused by the electric cable has been the disturbing cause of the gas-pipes.

St. Helens, March 1, 1906. S. GLOVER.

[There can be no doubt as to the seriousness of the peril arising from the overheating of bitumen-covered cables; for so we assume the cables in question were, seeing that the policeman who first discovered there was something wrong below the pavement in Upton Park in the early hours of the morning on which the half-dozen persons in one house narrowly escaped asphyxiation, reports that he noticed "smoke rising and pitch oozing from between the flagstones." This generation of gas from the insulating material of electric cables has been an all-too-frequent occurrence; and, for certain explosions which have been due to it, the ordinary gas supply of the district has, as a rule, received the credit, or rather the discredit. One of the electrical papers is fond of recording every petty gas accident that takes place, but does not, so far as we have noticed, discriminate between coal gas, sewer gas, and gas generated from electric cables. This particular case of six people being saved from death by suffocation, by the sagacity of a dog, apparently escaped the attention of the Editor of the paper last week; but perhaps the danger which this occurrence has emphasized will not be overlooked by the authorities who are concerned in the public safety.—ED. J. G. L.]

The Future of the Gas Profession.

SIR,—Under the above heading, I notice a letter from "An Old Hand." As this writer emphasizes the necessity of a knowledge of what "has been done" being gained from the reading of old books, may I be allowed to emphasize the necessity (quite as important) of acquiring a practical working knowledge of what "is being done"—to-day.

In my experience, there are only about 10 per cent. of the people engaged in the gas industry who know what "is being done" to-day. Of the other 90 per cent., some know what was done fifty years ago, that is not applicable to present requirements, and think it is their bounden duty to perpetuate these ancient practices; the rest buy plenty

of silk hats and kid gloves, conduct their retort-houses by means of the telephone, and make money.

If those engaged in the gas industry would take more to heart what appears each week in the "JOURNAL," and set about proving for themselves some of the results of working reported therein by visiting the necessary works and making proper inquiries on the spot, there would be larger dividends, larger salaries, and a healthier integrity in the industry.

From a historical point of view, it would be interesting to know: (1) How many people there are to-day washing their gas in their hydraulic mains with 2 or 3 inches of seal. (2) How many people there are to-day sending out gas of from 16 to 20 candle power at or under 15-10ths pressure.

Nuneaton, Feb. 26, 1906. GEORGE HELPS.

Gas versus Electricity.

SIR,—I see by recent issues of the "JOURNAL" that the "Battle Royal" for the standard of superiority wages as fiercely as ever between the rival camps—electricity and incandescent gas-light. The buyer of these two necessaries for our existence ridicules the idea of disputing a fact which is so intrusively asserting itself every day.

He does not care a pin for the laboratory tests or for elaborate tables of figures; his judgment is based upon his experience. He knows at this time of day that his money invested in incandescent gas-light shows an advantage in quantity and quality of light over that invested in electricity. He gets more for his money in the former case; and what he gets is the genuine article—viz., radiant light.

Everybody knows the advantages an electric light installation has over incandescent gas-lights in some respects; but these have no reference to the essence of the question—the light itself. They concern by-considerations—convenience and cleanliness, some people add, and decorative facilities. The latter being a consideration of a different order altogether, it does not have the importance to be introduced here.

Certainly, the electric light is very convenient, and is more cleanly; but besides the light question (which is the *crux* of it) it has already been amply decided and answered in favour of the incandescent gas-light. There are also other advantages which far outrun those of the convenience and cleanliness of the electric light.

Even the feature quoted against the gas-light, and of which so much is made—that of discolouring the ceiling—this is largely controllable by the proper use of a right burner and by exercising a little care and attention generally. Where combustion is complete, not only the elements for blacking the ceiling are wanting to a larger degree, but also the light is better and the saving of gas is greater.

In this country, where so much damp weather prevails, the incandescent gas-light has the inestimable advantage of far-and-away outweighing those mentioned in favour of the electric light—of warming and drying our rooms, shops, houses, &c., and causing natural ventilation. With just a loophole for the inlet and outlet of air into the open, not enough can be made of this advantage. And gas undertakings charge nothing for it! Either you pay for light and get the warmth for nothing, or you pay for warmth only.

What a miserable existence it would be in this country if we had only the electric light, with its friendless, cold, glittering, fixed illumination. It wants a fair number of incandescent electric lamps to obtain a light that gives light; and only well-to-do people can afford it. And besides, it wants much extraneous addition in the shape of ornamentations of all kinds, to give it an air of comfort; and even then the genial finish and warmth is wanting.

How different with the incandescent gas-light, with its radiant, warm, glowing light, the friendliness of its general air, and the warmth it gives off unstintingly.

On a drizzling day—one of those depressing, clammy days of which we have so many in this country—just step into a room lit with incandescent gas-light, and one with electric light. The latter stares at you—cold, condescendingly—like saying you are here for me, not I for you. The former you not only become aware of by the warmth of the light, but you experience the pleasurable sensation of the warm, dry atmosphere also. How gratifying it is.

For decorative purposes no doubt electric light is far more pliable; but this is certainly not (as observed already) the first consideration; and if it comes to decorative adornment, there is all the scope desirable for gas lighting as well.

Supposing even there were equal conditions as to price, the above advantages of the incandescent gas-light would always make it preferable to the electric in the majority of light-installations.

The better the general public get to know the points to be observed in handling the incandescent gas-light, the more its advantages are recognized and appreciated.

As the conditions are to-day, the advantages (starting from the low cost of the gas) are overwhelmingly in favour of gas-light by the incandescent burner and mantle.

Perhaps the objection raised to the air being vitiated in the case of gas, must be given consideration to here. If the burner is properly adjusted and attended to, the room (to the contrary), by judicious ventilation, should be healthier; for the heat causes a rapid change of air and a constant movement.

60A, *Wilson Street, E.C., Feb.* 27, 1906. C. J. ALEXANDER.

The Croydon Purifier Contract.

From particulars received from Messrs. C. & W. Walker, Limited, a paragraph appeared in the last number of the "JOURNAL" in regard to some purifier valves to be erected at the Croydon Gas-Works. To prevent misunderstanding, we are now asked to say that the order for the whole purifier installation at Croydon was placed with Messrs. Clayton, Son, and Co., Limited, of Leeds, who arranged for the delivery and erection of the Milbourne valves and fasteners only as subcontractors to the Leeds firm. The fasteners referred to are made by Messrs. C. & W. Walker, under royalty payable to Messrs. Clapham Bros., Limited, of Keighley, whose patent "Eclipse" rubber joint is being supplied to the Leeds firm to attach to their covers.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

(*Before Lords Justices* ROMER *and* COZENS-HARDY.)

Tuesday, Feb. 27.

Busbridge v. Ilford Gas Company.

This was an appeal from a decision of Mr. Justice Walton in Chambers.

Mr. DUKE, K.C., who appeared with Mr. SYLVAIN MAYER for the defendants, said it arose under these circumstances: In the year 1903, a great flood occurred in the valley of the Roding, at Ilford, and it must now be taken that, by reason of a mistake made by the Engineer and the defendants, part of the flood water was diverted over a low-lying area of land contiguous to their works; and the houses built thereon suffered damage. One or two actions had been tried before juries, as the result of which the defendants had to pay for the damages caused. In one case, in which the Ocean Accident and Guarantee Corporation, the owner of some 200 houses, were the plaintiffs, the question of damages was referred to Mr. Muir Mackenzie, the Official Referee, who spent a great deal of time in going into the facts and circumstances, visited the locality, and examined into the character of the soil, &c. He had made an award, so there was an end of that matter; and the defendants desired that the present action, in which the plaintiff was the owner of about a dozen houses, should go before the same Referee. For this purpose a summons had been taken out for leave to amend the defence by withdrawing the denial of liability, paying money into Court, and referring the question of damages to Mr. Muir Mackenzie; but the learned Judge refused to make the order.

Lord Justice ROMER asked whether the objection of the plaintiff was to going to a reference at all or to the particular Referee.

Mr. COOMBE, for the plaintiff, said his client did not object to a reference to the Official Referee in turn; the only objection was to defendants selecting one.

After some little discussion, it was arranged that the matter should take this course. The defendants admitting liability, the amount of damages to be determined by the Official Referee in turn, who should also deal with the costs.

Cheke v. Ilford Gas Company.

This was a similar case to the foregoing; but here the plaintiff had taken out of Court £15 which had been paid in; and Mr. Duke submitted that Mr. Cheke ought to pay the costs of the appeal, or, at any rate, ought not to have any costs. Mr. Mayer urged the same point at some length; but the Court, without calling on Mr. Leck for the respondent, decided that the appeal failed, and that they could not make any special order as to costs, which must follow the event.

CARDIFF GAS COMPANY'S ASSESSMENT.

Successful Appeal to Quarter Sessions.

Some interesting facts were elicited at the Glamorgan Quarter Sessions in the course of an appeal (the hearing of which was commenced last Tuesday) by the Cardiff Gas Company against the assessment of their properties in five county parishes outside the city.

Mr. ERNEST MOON, K.C., and Mr. RHYS WILLIAMS appeared for the Company; Mr. ABEL THOMAS, K.C., M.P., and Mr. JOHN SANKEY represented the Cardiff Union Assessment Committee.

Mr. MOON stated that last year the rating of the Company's undertakings was raised to £36,382 gross, and £20,892 net—an increase of 32·26 per cent. The profits of the Company had increased by only 11 per cent.—from £34,000 in 1894 to £38,000 in 1905. This looked as though the gentleman who made the revaluation had the courage of his convictions. The gas industry was entering upon a new phase. Keen, active, destructive competition had arisen. A few years ago, the consumers of gas might have been included in these categories—the domestic, the business, and the public. Then came electric lighting. It was not until 1903 that the competition of the Cardiff Corporation, who had secured electric lighting powers, began to be felt by the Company, and they lost some of their most profitable customers. Then there was the Penarth Electric Light Company; and recently the Gas Company were served with notice from the Local Council that they intended to discontinue to a large extent the use of gas and to employ electric light. Suction gas, too, had been introduced largely by manufacturers, many of whom had also discarded gas for electricity.

Mr. *Humphreys Davies*, valuer, said that the price of gas in the Cardiff Company's area was 2s. 9d. per 1000 cubic feet, except at Radyr, where it was 3s. 3d. The charge for gas for engines had been reduced to 2s. 6d.; and the competition of suction gas and oil would necessitate a further reduction. A discount of 5 per cent. was allowed on gas consumed to the extent of 200,000 feet per quarter, and of 2½ per cent. on 100,000 feet. In 1901, over 400 million feet of gas were consumed; in 1904, 458 millions; but in 1905, only 451 millions.

Mr. THOMAS complained that he was unable to test the accuracy of these figures, as the Company refused access to their books.

Mr. MOON explained that an inspection was asked for covering ten years. They had supplied the other side with copies of accounts, but refused to allow them a roving inspection of their books, because at the present time the Company had a Bill in Parliament which the Corporation were opposing.

Mr. THOMAS said there was no question of a roving commission. They were not allowed to see any of the books.

Witness (continuing) submitted figures showing the extent to which the appellants had been affected by competition.

The CHAIRMAN (Judge Williams) said he supposed witness wanted to impress the Bench with the fact that the Company were not paying their way.

Mr. THOMAS said it might be imagined that the Company had not paid a maximum dividend for the last thirty years.

Witness (continuing) stated that the penny-in-the-slot system had increased the demand for gas for domestic purposes; but it had also entailed a large increase in capital. The Company had in a way "cut their own throats" by introducing all sorts of inventions for improving the light and reducing the consumption. He put the rateable value of the undertaking at £12,000.

In reply to Mr. THOMAS, witness admitted that, when consulted, he had advised the Company not to allow the Assessment Committee to roam through their books.

Mr. THOMAS: Is there any secret in the way in which these books are kept?

Witness: Not that I know of; but they contain information not material for rating purposes which it would be inadvisable to allow the Assessment Committee to obtain in view of the Company's Bill, which is being opposed by the Corporation, some of the members of which are also members of the Assessment Committee. He went on to say that the concern was a prosperous one; but the nature of the business had changed in consequence of competition. In his opinion, a hypothetical tenant should make a profit of 17½ per cent., 2½ per cent. of which would be for risks.

Re-examined by Mr. MOON, witness said that the Cardiff gas undertaking was prosperous, and had always paid its dividends; but it was not now so remunerative as it had been, more money having to be spent on prepayment installations and in repairs of cookers, stoves, &c. A profit of 15 per cent. was not an unusual one for a prosperous firm to make.

Mr. *Corbet Woodall* said he had acted as engineer and adviser to the Cardiff Gas Company, and was well acquainted with the undertaking. His conclusion was much the same as that of Mr. Humphreys Davies. The chief difference was in regard to repairs and maintenance, for which he allowed 5½d. per 1000 cubic feet, while Mr. Humphreys Davies allowed only 5¼d.; and this made a difference of about £1000 in favour of the appellants. In witness's estimate, the net receipts were £49,000, of which the occupier's share would be £23,000. The gross rental was £27,568; and the rateable value, £11,203. He thought that more money should be expended in the upkeep of the works in the future than in the past. From £50,000 to £60,000 would shortly have to be spent on renewals, most of which would have to be provided out of revenue. This had been under the consideration of the Directors. They were building new retort-houses, which would be charged to capital; the value of the old works, which would be demolished, being charged against the capital of the new works. If the money was to be repaid within a moderate period, it would add considerably to the expenditure on repairs and renewals. Witness further stated that since 1896, when a compromise was effected with the Assessment Committee, the business of gas companies had altered materially in the way of requiring more tenant's capital comparatively to landlord's capital. He considered that the tendency now was to recover consumers from electric lighting, because a superior light could be obtained from gas companies at a lower price. The Company had been compelled to adopt the prepayment system to keep up the consumption.

In cross-examination, witness admitted that the new retorts spoken of would increase the earning capacity of the Company; and this would mean increased rateable value.

Mr. *George Clarry*, Secretary to the Company (who was called at the request of Mr. Thomas), said that he knew nothing about rating.

In cross-examination by Mr. THOMAS, he stated that since the compromise with the Assessment Committee in 1896, the Company had built new offices. Questioned as to whether the new offices were better than the old, he said at first he had no opinion on the matter. When asked what rent he would require if he wished to let the offices, he replied that he had not calculated the value of the old or the new. They were built because the old offices were inconveniently arranged. The present building occupied practically the same ground as the old one. He did not know what the new building cost.

The CHAIRMAN: You must really pull yourself together, Mr. Clarry. Give all the information you can.

Witness: I am going to look up the cost now. Later, he said that he thought the cost was approximately £12,000. But this did not form part of the £16,000 spent between 1896 and 1900; only about £6000 of it was included.

This closed the case for the appellants.

Mr. *Arthur Body*, a valuer, of Bristol and Plymouth, was the first witness for the respondents. He deposed to visiting the Cardiff Gas-Works for the Assessment Committee. The concern looked like a very successful one. Behind the premises in Bute Terrace there was a building used for ordinary purposes, the exterior of which was good enough for a mansion. Dealing with the accounts of the Company, witness said one item in the valuation in which he and Mr. Davies failed to agree was in respect of tenants' repairs and renewals. Mr. Davies put them down at £12,536, and witness at £6917. Witness then described the furniture of the offices. There was a Turkey carpet which cost £59. The Directors' room was most sumptuously furnished. He put the gross estimated rental, *plus* rates, at £45,454; and after making the statutory and other deductions, he fixed the rateable value at £25,272, compared with £28,755 gross and £12,290 rateable, as calculated by Mr. Humphreys.

Mr. *W. A. Valon*, of London, having given evidence,

Mr. *William Eve*, valuer, said the new part of the Cardiff Gas-Works was very well arranged. A large amount of money had been spent on the old portion—some of it, in his opinion, not very discreetly spent. The offices and other buildings were on a palatial scale. The works looked as if a large sum was expended annually upon them. He put the gross estimated rental at £38,339, and the rateable value at £25,492. Out of the stock of £4000, the sales of fittings, &c., only brought in £2500. It was not the way to do business to keep in stock double what they were going to sell during the year. A question arose with reference to a sum of £19,000, which witness said should be in the bank; but he was not allowed to see the books, and therefore was working to a certain extent in the dark.

The CHAIRMAN: Do not go into that again. If you had taken the proper means, as I said yesterday, you could have had the information.

Witness added that there was an amount put down for dessert spoons and forks, tablecloths, dishes, and frying-pans, the total amounting to £235.

Mr. MOON: Is the hypothetical tenant to have no luncheon?

Witness: He would not require all that is put down here.

Mr. THOMAS then addressed the Court on behalf of the Assessment Committee.

Mr. MOON made a speech on behalf of the Company, and pointed out that the assessment against which the Company were appealing was made upon Mr. Body's valuation, and that Mr. Body himself had admitted that he made the valuation on the basis that no sinking fund was to be allowed, and, further, that the fittings, meters, stoves, &c., were not tenant's but landlord's chattels.

The BENCH, after retiring, decided to allow the appeal with costs, and fixed the assessment as follows: Gross estimated rental, £32,000; rateable value, £18,000.

The assessment appealed against was: Gross estimated rental, £36,382; rateable value, £20,892. Mr. Humphreys Davies, the Gas Company's expert, had suggested gross estimated rental £28,755; rateable value, £12,290.

BRISTOL GAS COMPANY'S REGULATIONS.

Lead v. Iron Connecting-Pipes.

The Bristol Magistrates were last Friday week engaged for several hours in hearing a summons against the Bristol Gas Company for unlawfully refusing to give a supply of gas to John Lovell Scott, at No. 7, Collingwood Road.

Mr. THORNTON LAWES appeared for the complainant; Mr. F. E. WEATHERBY represented the defendants.

Mr. LAWES said that the summons had been taken out under section 36 of the Gas-Works Clauses Act, 1871, which imposed a penalty on the undertakers for the supply of gas if they neglected or refused to give a supply to any owner or occupier of premises. The house in question had recently changed hands; and Mr. and Mrs. Scott had taken it. Mrs. Scott wrote to the Company requesting the gas to be connected; but they replied that a connecting-pipe of lead, in a wooden trough, would have to be laid to their satisfaction up to the boundary wall of the garden. The existing pipe was an iron one; and this the Company declined to pass, with the result that Mr. and Mrs. Scott had been unable to use the house. The Company had not shown that the existing pipe was unfit and improper, but had unreasonably demanded that a lead one should be put in. Complainant had been a consumer of the Company's gas for some years; and the accounts had always been regularly met. The Company, however, insisted upon a lead pipe being put in at complainant's own expense, in place of the existing iron pipe, though that iron pipe had been there for twenty years, and was not worn, rusty, or leaky, and two plumbers who had recently examined it had no fault to find with it. If the Company refused to supply gas, he contended that they were liable to a fine of 40s. per day; and he asked the Magistrates to impose a substantial penalty.

Mr. and Mrs. *Scott* having given evidence in accordance with the opening statement,

Mr. *J. P. Morgan*, a plumber, said he had examined the pipe, and found it in excellent condition. It certainly was reasonably good for the purposes for which it was required. Some few years ago, the Company decided that the connecting-pipes should be of lead; but since then he had known of cases of iron pipes being accepted.

Cross-examined: He knew that, on a change of occupancy, the Company had called upon the new comer to put in a lead pipe for the existing iron one. He examined the pipe the previous day with another plumber, and saw nothing whatever wrong with it.

Mr. WEATHERBY, for the defence, contended that the action of the Company had been as much in the interest of the consumer as in their own. It was a course they had adopted in all parts of Bristol (owing to the liability of iron pipes to corrode), whenever there was a change of house occupancy; and the demand had been complied with in all instances without application to the Magistrates. He maintained that the point to decide was whether the requirement was a reasonable one; and he ventured to think that the corroded iron piping he produced was more conclusive on the point than any verbal evidence.

Mr. *John Phillips*, Secretary of the Company, said there had been no inspection of the iron pipe in question, nor approval of it expressed, either verbally or in writing. In a very large number of cases since the Act of 1899, which gave them power to substitute a different material for iron, the Company had called for the substitution of lead pipes for iron. Power to do this had been taken by the Company, because experience showed that lead pipes were safer and better for underground carrying than iron. The pipes were laid at the house in question in 1885.

Mr. LAWES said he had admitted this from the first.

Evidence as to the unsatisfactory character of iron piping as compared with lead having been given by *W. M. Collier*, Assistant Mains and Services Foreman, and *Albert Jones*, Superintendent of Mains,

Mr. *D. Irving*, the Engineer, said he had inspected No. 7, Collingwood Road. He had seen that part of the connecting-pipe where it went below the asphalt path, and it showed undoubted signs of corrosion. As an expert, he said it would be unreasonable to expect the Company to send gas through such a pipe. He certainly would advise them not to do so.

Cross-examined: No tests were made of the service-pipes unless there were special reasons. He was sorry to say that there were hundreds of iron pipes still in use. They were dangerous to the extent that he should think that the Company were fully justified in relaying whenever they could lead pipes in the place of iron.

Mr. LAWES: You can do so now, if you like; but you want to compel us to pay for the substitute. If you hand over the expense, we have no objection to the change.

Counsel having addressed the Bench, the Magistrates retired; and on returning into Court,

The CHAIRMAN said: We have come to the conclusion that the case must be dismissed. There is no evidence that this service-main was laid under the direct superintendence of the Gas Company's servants, though they no doubt accepted the service as laid. It has also been proved to our satisfaction that a wrought-iron pipe, such as the one in question, is, after remaining underground for 20 to 25 years, capable of allowing an escape of gas. The complainant has failed to bring evidence, which could have been obtained, that the pipe now underground is in good repair.

An application by Mr. WEATHERBY for costs was refused.

THE POLLUTION OF AN EDINBURGH BREWERY WELL.

The action at the instance of James Muir and Son, Limited, Calton Hill Brewery, Edinburgh, against the Edinburgh and Leith Gas Commissioners, was before the Second Division of the Court of Session on Saturday. In the action, as has been previously stated, the pursuers seek to recover £10,000 as damages for the alleged pollution of the Stable Well in their brewery; and Lord Ardwall, in the Outer House, awarded them £3730 with expenses. The Gas Commissioners reclaimed; and at the hearing last month, the Second Division allowed the pursuers time to consider whether they would amend their statements on record (*ante*, p. 434).

Mr. GUTHRIE, K.C., said they had lodged a minute of amendment, and had communicated it to the other side. The first amendment read: "It consisted of tarry bye-products of the defenders' manufacture of gas, chiefly water gas, and percolated from the defenders' works to the pursuers' well through the intervening strata, which dip in the direction of the well." Then, further on, the record said (the added words being given in italics): "Said pollution is directly due to the aforesaid operations, *or to other operations* of the defenders, *in carrying on the manufacture of gas and dismantling their plant*. The explanations *and averments* in answer are denied." Then they had added a new plea, as follows: "In any case the defenders being the authors of an *opus manufacture*, and having failed to prevent a noxious effluent therefrom from percolating into and polluting the pursuers' well, are liable in damages therefor." In short, they had put their statements into more specific form than existed on record. Their submission was that they were entitled to make these amendments, and to ask their Lordships to allow them to be made; the defenders, of course, being entitled to make any answer they might think fit. The intention of the pursuers was not to ask any more proof. They had tabled the case, and exhausted their proof, on the general case, as well as on the special case.

The LORD ADVOCATE (Mr. T. Shaw, K.C.), for the defenders, said he submitted, at the former hearing of the case, that it was too late, at this stage, to make amendments; and he cited two authorities in support of his view. The Gas Commissioners were confronted with a case which was so specific that the averments came up to an allegation that the pollution complained of directly resulted from a certain operation. They defended the case, and to all intents and purposes defended it successfully. However, certain facts were elicted by the Lord Ordinary; and upon them he had made a case which, in their view, was not on the record. Their Lordships had heard his view, that the amendments were too late. The other view was, assuming that the case was to go on, upon what conditions should it do so? The condition should be that the pursuers pay all the expenses. If the whole expenses were not allowed, all the expenses not available in the subsequent proceedings should be. His clients were now confronted with a general issue. They had entered into a contract for the boring of the strata, being resolved to satisfy themselves whether or not pollution was going on. This would take a considerable time, and it may be that their whole attitude towards the pursuers might be changed altogether, as a result of the borings. They proposed to abstract all the water from the strata, if necessary. They did not want water going down there at all. Their hope was to disprove the general case. In these circumstances he would rather not answer the amendments at once.

Mr. GUTHRIE submitted that, in any case, the question of expenses should be reserved.

The LORD JUSTICE-CLERK, after consultation with his brethren, said the Court would allow the amendments, reserve all questions of expenses, and permit the defenders, if so advised, to put in answers thereto.

The case now stands over till Saturday, May 12.

Embezzlement by a Water Collector.

At the Clerkenwell Police Court, on Monday last week, Francis Crawford Inglis, 36, of no fixed abode, was charged on remand, before Mr. D'Eyncourt, with embezzling and stealing £7 5s. while a servant of the Metropolitan Water Board. It was stated that the total amount of the defalcations was about £316. The prisoner, who was a collector, gave himself up at King's Cross Police Station. Detective-sergeant Cunningham had held a warrant for his arrest since November. Mr. George Elliott prosecuted; Mr. Tilley defended. Mr. Elliott said it was an extremely sad case. The prisoner had been in the employ of the Board and their predecessors for 20 years, and his honesty had never been questioned. An inquiry had been set on foot, owing to the complaints of persons who had paid their water-rate and were again charged. It had been going on for about 18 months. The Board were obliged to take up the case; but they did not desire to press it, and would be satisfied if the Magistrate would deal with it. The prisoner had lately been in the hands of money-lenders. Mr. Tilley urged that this course would satisfy justice, and save further cost to the ratepayers. His Worship said the amount was too large, and the length of time too great, for him to deal with the case. He committed the prisoner for trial, allowing bail.

MISCELLANEOUS NEWS.

JUBILEE OF THE COAL-TAR COLOUR INDUSTRY.

Proposed Testimonial to Dr. Perkin.

According to the intimation which appeared in the "JOURNAL" for the 20th ult., a meeting was held at the Mansion House, on Monday last week, under the presidency of the LORD MAYOR (the Right Hon. W. Vaughan Morgan), to consider what steps should be taken to commemorate the discovery by Dr. W. H. Perkin, fifty years ago, of the first artificial colouring matter obtained from a product of coal tar, and to celebrate the great development of the industry thus started. Among those who attended were Lord Halsbury, Lord Rayleigh, Sir William Ramsay, Sir James Dewar, Sir Henry Roscoe, Sir William Crookes, Professor F. Clowes, Mr. David Howard (the President of the Institute of Chemistry), Sir Boverton Redwood, Dr. F. B. Power, Dr. T. E. Thorpe, C.B., Mr. A. Gordon Salamon (the Chairman of the London Section of the Society of Chemical Industry), of Leeds, and Professor A. G. Green (the Hon. Secretary of the General Committee).

In the course of a circular-letter calling the meeting and setting forth its objects, Professor Green said that the present year marked the 50th anniversary of the epoch-making discovery by Dr. Perkin of the dye-stuff "mauve," by which the foundation was laid of the coal-tar colour industry, and a great stimulus given to the study of organic chemistry. The discoverer being fortunately in full activity, it had been widely felt in this country and abroad that the jubilee of the foundation of this important industry should be made the occasion of a fitting public tribute to him, in recognition of the great services he had rendered to chemical industry and chemical science by his life-work. Assurance had been given that the movement, if inaugurated here, would meet with the warmest support in Germany, where the seed first sown by Dr. Perkin had grown into an industry of national importance worth many millions a year. Those connected with the industry in Germany would, it was believed, welcome the opportunity of according to its founder some mark of appreciation and gratitude, while it was also probable that in other countries a generous measure of support might be counted upon.

Lord HALSBURY, who opened the proceedings, remarked that no one could be more truly said to have kept himself in the background than Dr. Perkin; and he deserved recognition by his fellow-subjects. He was a man of real science, and he achieved great success by what he did. The nucleus of the German coal-tar colour industry could be traced back to Dr. Perkin's discovery; and in an interesting article which had appeared in "The Times," it was stated that five large firms in Germany engaged in the industry had command of a capital little short of £5,000,000, on which during several years past they had paid dividends of from 20 to 30 per cent. per annum. The Germans themselves were ready to join very heartily in the present movement; while other countries had indicated their desire to co-operate. It would therefore be an international one. He moved the following resolution: "That, in view of this being the fiftieth year of the foundation of the coal-tar colour industry, it is desirable that steps should be taken to memorialize the event and to do honour to Dr. W. H. Perkin, the founder."

Sir WILLIAM BOUSFIELD seconded the motion; and it was carried unanimously.

Lord RAYLEIGH said he was certain he was expressing the universal feeling of the scientific world when he congratulated Dr. Perkin on having lived to see the immense success which had arisen out of his discovery, made almost in his boyhood. With this feeling of congratulation, there was associated one of regret that the fruits of the discovery had been allowed to go out of this country, as they had done. He moved: "That an appeal be made in this country and abroad for subscriptions for the purpose of carrying out the following objects: (1) The presentation to Dr. Perkin for his lifetime of an oil portrait of himself, executed by an eminent artist; the portrait to become the property of the nation at his death. (2) The execution of a marble bust of Dr. Perkin, to be placed in the rooms of the Chemical Society. (3) The establishment of a 'Perkin Research Fund' for the promotion of chemical research, to be administered through the Chemical Society."

Sir WILLIAM RAMSAY seconded the motion; observing that Dr. Perkin had passed a lifetime in patient research.

Sir HENRY ROSCOE, in supporting the motion, remarked that Dr. Perkin was an example of what a man devoted to science, and resting alone on his own efforts and knowledge, might effect, both as an investigator of pure science and as one who applied his science to the benefit of mankind. They might well ask themselves the question how it came about that the great industry which he inaugurated had passed over from English hands to those of the Germans. The real reason could not be more concisely expressed than in the words of the article to which reference had been made.

Mr. HOWARD also supported the resolution, which was adopted.

Committees were then appointed to carry out the objects set forth in the resolutions; and a vote of thanks to the Lord Mayor brought the proceedings to a close.

In the course of the article in "The Times" referred to by Lord Halsbury and Sir Henry Roscoe, the writer said: "Although in this country there have never been wanting capable chemists able to carry on and extend the manufacture of colouring matters, there has been complete lack of understanding on the commercial side of the complex requirements of the industry, and complete lack of sympathy between the capitalist and the scientific worker. The failure must be credited to our Universities and to our faulty system of higher education—to our inbred Philistinism. Little, if anything, has been done, either in school or in University, to evoke in the community even an elementary understanding of the principles of science and of their application to commerce and industry. We are now paying the penalty of our neglect." These were most probably the remarks specially alluded to by Sir Henry Roscoe.

WEST HAM GAS COMPANY.

A Successful Half Year and an Increased Dividend.

The Half-Yearly Meeting of this Company was held last Tuesday, at the Liverpool Street Hotel, E.C.—Mr. J. L. GODLEE in the chair.

The SECRETARY (Mr. A. G. Snelgrove) read the notice calling the meeting; and the Directors' report and the statement of accounts were taken as read.

The CHAIRMAN said it was a pleasure to him to move the adoption of the report and accounts, as they were so satisfactory again this year. It would be noticed from the accounts that the Directors had not yet issued any part of the capital which the proprietors authorized them to raise at the meeting last August. There was now a balance of only about £9000 of capital; and the Directors were hoping to raise additional money within the next two or three months. The present price of the stock in the market made it reasonable to expect that they would be able to dispose of ordinary stock on favourable terms. In looking at the accounts, and comparing them with those for the corresponding half of 1904, they had to keep in mind that the price of gas was lowered from 2s. 11d. to 2s. 10d. per 1000 cubic feet last Midsummer, as a result of which the gas rental was £3050 less than it would have been if the old price had been maintained. A penny reduction in price meant something over £6000 a year. The stockholders might, he thought, congratulate themselves that, notwithstanding this reduction, the Directors were able to provide for the additional dividend authorized under the sliding-scale, and to increase the amount carried over to the next half year by £2495. The sum carried forward was, therefore, £13,676; and £12,665 was now standing to the reserve fund. These two amounts gave them rather more than £26,000 in hand. The quantity of gas sold during the half year was 731,932,000 cubic feet; being an increase of 9·1 per cent. on the previous year. The increase for the whole year was 8·3 per cent. During the first two months of this year it had again been about 9 per cent.; and it seemed still necessary to calculate for an increase at about this rate in making their arrangements for the future. The number of consumers during the year had been augmented by 8430, of whom 7427 were using automatic meters, and 1003 ordinary. The total number of the former was now 21,099; while the consumers by ordinary meters numbered about 21,000. Therefore, they had now just about an even division between the slot meter and the ordinary meter consumers. When they obtained their Act in 1902, they calculated that their capital would last something like ten years, under the assumption that they would have 20,000 slot consumers. They had, as he had said, already 21,000, although only four years had passed since the Act was obtained. Regarding the accounts, it would be noticed that the cost of coal, oil, &c., was £42,896, as against £39,535 last year. This was an increase of 8·5 per cent.; while the increase of gas sold had been, as he had already stated, 9·1 per cent. For the whole year, the increase in the cost of coal, oil, &c., had been 2·24 per cent.; while the increase in the gas sold had been 8·5 per cent. At the same time, carbonizing wages, during the year, had been reduced by about ½d. per 1000 cubic feet of gas. These results reflected considerable credit on those who were responsible for the management of the works; and with this he was sure the proprietors would agree. While he was on the subject of coal, he might mention that, anticipating a rise in the price, they were able a year ago to arrange contracts on favourable terms for a period of two years; so that the rise in price that had recently taken place would not affect them this year at any rate. On the other hand, one could not close his eyes to the fact that the stoppage of so much of the supply of oil from Russia, consequent on the troubles which that country had passed through during the last year, might lead to some advance in the price of oil. The increased charge for repair and maintenance of works, &c., was largely accounted for by the writing off of certain obsolete plant; and the liberal charge for wear and tear and depreciation which had been continued, explained the increase in that for repairing, &c., of meters, lamps, and other appliances. Their rates and taxes continued to increase; but the disputed question as to the assessment of their works and mains, to which he had referred on previous occasions, was still unsettled, though it had been under consideration for a long time. The amount charged under this head for the past half year worked out at very nearly 2d. per 1000 cubic feet of gas sold. He hoped the Directors would see their way to a settlement of this question with the Corporation and other Local Authorities within a fairly short time. He ought to mention that they had, during the past year, made an alteration in connection with the collection of the gas-rental, by the institution of a separate rental department under an independent superintendent, by which department the whole of the collecting business was now managed and supervised. This step had been rendered necessary by the increase of their business; and the Board anticipated good results from the change. On the other side of the account, the receipts from consumers by ordinary meters showed a slight falling off, owing to the change of price; while those from slot consumers showed an increase of £6438—the total receipts for the year being £101,177, as against £95,854. The receipts from residuals exhibited a small increase, which was satisfactory; and they had done better than the previous year in the sale of their sulphate of ammonia. The result of the figures was to show a gross profit of £30,006, which, after the payment of the debenture interest and interest on consumers' deposits, left a net profit of £26,283; while the amount required to pay the dividend authorized by the sliding-scale was £23,737—giving, as he had already mentioned, £2495 to be added to the amount carried forward. He was looking at the accounts for 1877 the other day, and saw that the total receipts then were only £23,000, which was about £1000 less than they had now to pay in dividend. When he talked of lowering the price of gas six months ago, he said that probably they would like to carry the increased amount of dividend to which the proprietors were entitled to the reserve fund; but looking at the amount carried forward to the unappropriated profits, and to the sum standing in the reserve fund, the Directors thought the proprietors might safely decide to divide the extra dividend authorized by the sliding-scale, as mentioned in the report. This meant £466 extra dividend; while the consumers got something like £3000, which showed that the sliding-scale did work very favourably to the latter. If their business continued as satisfactory as it was now, they might be able, at a comparatively early date, to make a further reduction in the price of gas; but it was impossible to say anything definite in the matter just now. A penny reduction meant more than £6000 per annum diminution of rental; and the question as to the price they would have to pay for coal in the future had to be considered. But at the same time, any reduction that they could wisely and safely make was an item in their favour in their continually active rivalry with electricity, which had not, however, yet reduced them to a position of difficulty. The Company had been able to give substantial rebates to consumers using gas for gas-engines, and the Directors were making some further allowance in this direction. The large new holder at the East Ham works was materially helping them in the distribution of gas this winter; and out of the 6 miles of mains that had been laid during the year, 2 miles were 18-inch ones for the supply of gas to the Company's districts from these new works. A Bill had been presented to Parliament this year for forming a railway running round the outer limits of the Metropolitan area. He was inclined to think this was a "hardy annual" that had been going on for twenty years in one form or another. But this year it was purposed that the line should run through the land the Company occupied at East Ham; and a considerable piece of their property was included within the limits of deviation. If the scheme were carried out, it would seriously interfere with the use of their land, and very greatly diminish its value to the Company. Under these circumstances, a petition had been presented by the Company against the Bill; and the Directors intended to oppose its passing unless some very different plan was adopted. They were, he might add, only one of 62 petitioners. He could not finish his remarks without assuring the proprietors that one conclusion they had all probably come to in looking at the accounts was, he believed, quite correct—namely, that the Company were admirably served by those who superintended and carried on their business in every branch of the works. The Company had a good staff of officers and servants who worked heartily and loyally to promote its best interests. He said this with the knowledge that came from constant association and work with them; and he believed it to be absolutely true.

The DEPUTY-CHAIRMAN (Mr. T. S. Geere) seconded the motion.

Mr. KENNETH BROWN said the shareholders were very satisfied with the position the Company was in. In the report, it was stated that a considerable amount of the increase in gas consumption was due to the growth of the prepayment supply. He noticed in the revenue account that the gross revenue had increased by £7820, and the cost of this was £7820; making the profit £167 less on nearly £8000 more business. The 1d. per 1000 cubic feet reduction made about £3050 on the 732 million cubic feet sold; so that there was still an increase in the cost of £4737 in earning a less profit. He should like the Chairman's opinion as to whether the prepayment business was really quite as profitable as it was supposed to be.

Mr. CLEVERLY, referring to the proposed increase of dividend, said it appeared to him that it was a thing that appealed rather to the speculator than to the investor. He thought they would be better advised to put the whole of their increase of profit to the reduction of the price of gas rather than raise the dividend, especially in view of of the comparison with which they had to contend in connection with a neighbouring Company. The Commercial Company's price for gas was considerably lower than their own; and in future they might have to contend against a giant enemy. The electric light people were always promising things which never came. But supposing electricity did come down to 1d. per unit, it would be a much more powerful competitor. Had they better not sell gas at the lowest possible price, so as to cut the ground from under the feet of the electrical people? Regarding bad debts, he asked whether the Company were not exercising a little unrequited leniency to those of the consumers who were the least profitable—those who did not want to pay. Then, with respect to the residuals, were they, he inquired, making the most of them? Were they buying in the cheapest market, and selling in the dearest? It was a notorious fact that German firms were making enormous profits out of the products of British gas-works. It was a pity that these materials could not be worked up to the direct advantage of the Company.

The CHAIRMAN, in reply, said he did not know that they ever put it forward that prepayment meters were a very paying business. It was, however, a business that did pay, and enormously increased their facilities to work to the greatest advantage. It was, therefore, on the whole, good business; but not of the most lucrative form. It also put a supply of gas in possession of a great number of people who would not otherwise be able to get it. All he had to say about paying an increased dividend was that he thought it was really a wise thing to do, and to postpone for a little time adding money to their reserve fund. The reserve fund stood at a large figure; and he therefore thought the proprietors might safely take something to themselves. The dividend of the Commercial Company was larger than their own. As to selling the gas at as low a figure as possible, as soon as they could safely do it, they would certainly further reduce it. As to residuals, he thought they were in a happy position. At any rate, they had done better than most people. Up to the present, however, the Directors had not seen their way to set up as chemical manufacturers (excepting in the matter of sulphate of ammonia); and until they could do this, they were bound to let other people make profit out of their residuals. There were, of course, larger gas companies than themselves who were chemical manufacturers; but their own Company were not in such a fortunate position. In the point of bad debts, he hoped that the collectors would not be too lenient; but they had rather a difficult task sometimes.

The motion was unanimously adopted.

Proposed by the CHAIRMAN, and seconded by Mr. H. CECIL PELLY, a dividend at the rate of £5 2s. 6d. per annum was declared.

On the proposition of the CHAIRMAN, seconded by Mr. HOWARD TANNER, Mr. J. J. Griffiths, one of the retiring Directors, was re-elected. The Chairman also retired on this occasion; and he, too, was unanimously returned to his seat, on the motion of Mr. ROBERT CARTER, seconded by Mr. F. H. PILLEY.

The retiring Auditor (Mr. John Brooks), who has filled the position since 1878, was also re-appointed.

Accompanied by suitable expressions of the appreciation of the proprietors, the Rev. T. TEED HEAVER proposed, and Mr. CLEVERLY seconded, a vote of thanks to the Chairman and Directors.

This was unanimously agreed to, and duly acknowledged.

A similar compliment was paid to the officials and their staffs, on the motion of Mr. PILLEY, seconded by Mr. JAMES RANDALL.

Response was made by the Engineer and General Manager (Mr. John Clark), the Secretary (Mr. A. G. Snelgrove), and the Superintendent of the collecting staff (Mr. G. T. Gwinn).

This terminated the proceedings.

SOUTH SHIELDS GAS COMPANY.

Gas-Mains and Tramway Track.

The Annual Meeting of the South Shields Gas Company was held last Tuesday, under the presidency of Dr. ARMSTRONG.

The CHAIRMAN, in moving the adoption of the report, congratulated the shareholders on the highly satisfactory state of affairs. He said he would like to point out to them the advantageous position they were now in, compared with five or six years ago. Then they had to grapple with plant that was dilapidated and out of date; and they were a long way behind the times. Their stock value at that time fell to 143 per cent.; while it was now selling for 161 per cent. During the last five or six years they had almost completely recast and renewed the Shields works; and they had been able to do this without materially increasing the capital account. Now they were contemplating the recasting and renewing of the Jarrow works, which were sadly out of order. They would put them into a more economical working condition. Under the Act of 1904, they had got rid of an offensive process in the purification of the gas, which, while it cost less, also increased the illuminating power. The balance-sheet showed that they were able to carry forward a sum of £4061, after paying the statutory dividend. They must not forget that in 1904 they reduced the price of gas 2d. per 1000 cubic feet; while last year they again reduced it 2d. in the borough, 11d. in the added area, and 7d. in the old districts. The consumers' benefit on account of these reductions last year was close upon £7000. The past twelve months would have been very uneventful if it had not been for the action of the South Shields Corporation in putting down their electric tramway track and cementing over the gas-mains. At the present time there were 5000 yards of the Company's mains buried under the concrete; and when the tramways undertaking was finished, there would be 8000 yards of gas-mains lying immediately beneath the tram-lines, and he would not like to say how many service-pipes. The Company sent a deputation to meet a Special Committee of the Corporation about the matter; and the Corporation promised to make them an offer with reference to the removal of the mains from beneath the lines, and placing them instead at each side of the rails. But they had not made any offer to the Company, and still they were continuing to bury the mains beneath the track. They were prepared to meet the Corporation in a most liberal way with regard to outlay. The expense to get at these mains in future would be considerably increased. Every time they put a new service-pipe in, they must break through the cement, and cement the place over again. He believed that by Act of Parliament the Corporation were obliged to bear the extra cost of this—at least, so far as the old mains were concerned. The work of opening out the mains in future would be very expensive. They would have to stop the tram service; and this would lead to serious difficulties and friction, he believed, between the Corporation and the Company. The charges with regard to public lighting in the borough were under consideration, though negotiations were being unnecessarily prolonged. During the past year they had lighted the thoroughfares to Boldon and Harton with incandescent lamps, which had given great satisfaction to the public lighting authorities of both districts. The Company for a small yearly sum now maintained incandescent lights in consumers' houses; and it was being largely taken advantage of, because they used less gas and gave a better light. The consumption of gas for the year had increased by 11,051,593 cubic feet, as against the previous year; but while they had sold more gas, the revenue was £2393 less, owing to the reductions in price. The revenue from coke and tar had somewhat decreased, owing to the falling off in demand on the Continent. They had placed 2103 additional slot meters during the year; the number now in use being 9170. The gross revenue for the year was £81,225, and the expenditure £60,202; leaving a balance to profit of £21,022. The balance from last year was £2811, which made a total of £23,834. They paid a 4 per cent. dividend in the first half of the year, which absorbed £7665; and they proposed to pay now another 4 per cent., making 8 per cent. for the year. The interest on mortgages was £3492; and they transferred to the insurance fund £500, which left a balance to carry forward of £4061.

The report was adopted, and the dividend recommended was declared.

Sulphur Compounds at Coventry.—An increase of sulphur compounds in the gas at Coventry gave rise to some discussion at the last meeting of the Town Council, when Mr. Gardner wanted to know the reason for this rise, which amounted to something like 16 grains per 100 cubic feet. This had occurred, he said, since the Gas Committee were given permission to alter their system of purification; but he thought the matter was one requiring explanation. Mr. Hill, the Vice-Chairman of the Watch Committee, who have charge of the street lighting, said the question had not been lost sight of—in fact, it came forward at almost every meeting of the Committee. He understood that when the new works at Foleshill were in full operation the sulphur compounds would revert to their normal level. The Mayor also pointed out that there had been great demands on the Gas Department lately. Mr. Batchelor, the Chairman of the Gas Committee, said it would be two years before the new works were in full swing. It was promised that the matter should receive the attention of the Watch Committee again at their next meeting.

PROVINCIAL GAS AND WATER COMPANIES.

Gas.

The Price of Gas and the Sliding-Scale at Aldershot.

In moving the adoption of the report and accounts at the half-yearly meeting of the Aldershot Gas and Water Company, Mr. A. F. Wilson, the Chairman, said the revenue from gas showed an increase of £770, which was very satisfactory indeed. Against this, however, a smaller sum had been received for coke and sulphate of ammonia. The income from water exhibited what was practically the normal growth of £240. The receipts from gas would have been still larger but for the fact that at the commencement of July the Directors considered it possible to reduce the price to the outside districts. At Farnborough and in all the out-districts they reduced the charge from 3s. 8d. to 3s. 5d. per 1000 cubic feet; and a considerably increased consumption in the district showed that the consumers appreciated the reduction. They were encouraged to make these reductions by looking to the possible consequence—that cheaper gas generally meant larger consumption. As from Jan. 1 last the price of gas in Aldershot has been reduced from 2s. 8d. to 2s. 7d. per 1000 cubic feet; while slot-meter users receive 23 cubic feet per penny, instead of 22. One feature for congratulation was the small increase in the cost of coal as compared with the previous year. They had made considerably more gas; but owing to the favourable rate at which their contracts were made, the larger quantity of coal had not cost a much greater sum. In responding to a vote of thanks, Mr. R. W. Edwards, the General Manager, referred to the action of the sliding-scale and its operation so far as the Aldershot Gas and Water Company was concerned. He said that, to his mind, it did not represent a fair division. In most of the companies which were under the sliding-scale, there was about 5s. per cent. for every 1d. reduction in the price of gas; and the 5s. applied to all the ordinary stock. But in regard to the Aldershot Gas and Water Company, instead of 5s., they had 3s. per cent., because of being a water company as well; and it applied to the original capital only, whereas the total ordinary capital was double that. A penny reduction in the price of gas to the ordinary consumers in their Company yielded a saving of £450; while to the shareholders it put £45 in their pockets. Therefore they took one-tenth, while the consumers took nine-tenths of the surplus profits of the undertaking. The consumers had never appreciated fully the benefits they derived from the application of this very remarkable sliding-scale; and he knew of no other company which had a sliding-scale that operated so disadvantageously to the shareholder and so advantageously to the consumer.

Good Increase at Brighton.

The accounts for the six months ending Dec. 31 last which the Directors presented at the half-yearly meeting of the Brighton and Hove Gas Company showed an increase in the sales of gas of 4·9 per cent., as compared with 1904, and an additional revenue of £2135 therefrom, notwithstanding the reduction of 1d. per 1000 cubic feet in the price, which came into effect at the beginning of the year. The quantity of gas sold was 581,743,700 cubic feet, and it produced a revenue of £83,229; the total receipts being £104,792. The expenditure on the manufacture of gas was £50,812; on distribution, £17,152; and on management, £4573—the total expenses being £78,162. The balance carried to the profit and loss account was £26,630; and the amount available for distribution was £36,372. Out of this sum, dividends at the rates of 6, 4, 11¼, and 8¼ per cent. per annum were declared on the different stocks of the Company, amounting to £24,236; and the balance (£12,136) was carried forward.

Remodelled and Enlarged Works at Brixham.

Since the purchase of the old Brixham Gas-Works (established in 1838, with an authorized capital of £6000) by Mr. W. A. Schultz, the new Company (incorporated by Special Act in 1904, with an authorized capital of £20,000) have purchased additional property, thus enlarging the area of land to provide for future extensions. Besides this, the works have been remodelled and enlarged, new mains laid throughout the town, and extensions made in Higher Brixham and Furzeham. The increase in the sale of gas has been in keeping with the work of reconstruction. In 1903, 7,619,300 cubic feet were sold; in 1904, 8,903,000 cubic feet; and last year, 11,516,000 cubic feet. As the result of an exhibition in May last, there was a large accession of customers; the increase being from 354 to 643. Presiding at the annual meeting last Saturday week, Mr. Schultz said that, with the exception of the second gasholder, there was nothing at the works now which was taken over from the old Company. The report (which was adopted) showed a profit of £939; and after payment of interest on temporary loans and the interim dividend on the preference shares, there was a balance of £812. The full dividend of 5 per cent. was paid on the preference shares; and the Directors recommended a dividend of 5¼ per cent. on the additional ordinary shares, and 7½ per cent. on the original ordinary shares—leaving £86 to be carried forward. It was stated that a Bill (which is receiving the support of the Brixham Urban District Council) is being promoted in Parliament to confer on the Company powers to produce and supply electricity, and to raise additional capital for the purpose.

Cheaper Gas at Canterbury.

The past year was a good one for the Canterbury Gas and Water Company; and hence the Chairman (Mr. D. Amos) had a pleasant task in presenting the report to the shareholders at the annual meeting. He said that during the year they had had their new regenerative system of carbonization in full working order, and the result was most satisfactory. They had made more gas per ton of coal, had used less coke as fuel, and could show a decrease in the cost of labour. They had fitted up a new and larger condenser. One object they had in view in this was the prevention of the nuisance caused by naphthalene depositing in the service-pipes; and he was glad to state that they had in a great measure effected this. They had now comparatively few complaints. Residuals had not been quite so productive; and there was a slight falling off in the quantity of gas sold. The latter, however, was fairly attributed to the very mild autumn and to the increased adoption of

the incandescent mantle for domestic and business purposes. The increase of customers, both ordinary and prepayment, had gone on without intermission; and there had been no pause in the growth of the popularity of gas cookers and fires and other heating appliances. The balance standing to the credit of profit and loss account enabled them again to pay their full statutory dividends for gas and water; and as they had every reason to believe that their business would continue to progress, they recommended a reduction in the price of gas of 2d. per 1000 cubic feet, as from Jan. 1 last, making it 2s. 8d., which would compare favourably with any inland town. This was a very pleasing duty, inasmuch as in so doing they made a concession to their customers equal to £1210 per annum; and, under they new sliding-scale, they could pay an additional dividend to the shareholders. He need hardly say, should there be any material alteration in the upward tendency in the price of coals, the Directors would be fully justified in raising the price of gas, so as to meet the increased cost of manufacture which that would entail; but they did not anticipate this happening. A cordial vote of thanks was passed to the Secretary (Mr. J. Burch).

A Slightly Decreased Consumption at Cork.

A small decrease of between 1 and 2 per cent. in the consumption of gas during the past half year, as compared with the corresponding period of 1904, has not prevented the Cork Gas Company from paying their maximum dividend of 8 per cent., and adding a substantial sum to the reserve fund. The Chairman (Mr. George Lynch) explained at the meeting that the small falling off was accounted for partly by the unusually mild weather that prevailed up to the close of the half year, and partly by the constantly increasing use of the incandescent system. This latter cause was operating everywhere to prevent what used to be the usual steady increase in the quantities sold. This, however, was not a matter of regret, as the slight diminution in sales was more than compensated for by the largely increased satisfaction afforded to the customers, who got a better light for a smaller consumption of gas. The very best incandescent mantles, which a few years ago cost 1s. 3d. each, could now be had for 4½d.; and it is the best economy to buy them, instead of paying a penny or twopence less for ones of inferior quality, which neither gave so good a light nor lasted so long. The number of consumers continued to increase steadily. During the past half year, the Company have put in a net increase of 64 ordinary meters, 162 slot meters, and 258 stoves for cooking or heating, besides a large number of smaller appliances. A shareholder present remarked that the proprietors owed the Directors and the management their gratitude for the capable way in which they carried on the business. The smallest complaint made by any of their customers was attended to immediately.

Rising Rates at Eastbourne.

Dr. G. A. Jeffery, J.P., the Chairman of the Eastbourne Gas Company, had an unpleasant topic to touch upon at the half-yearly meeting, in the shape of the everlasting increasing burden of rates and taxes. This item, for the past six months, shows a rise of £156; the amount being £1422, which, as was pointed out, the Company are obliged to contribute without having any voice whatever in the expending of it. Dr. Jeffery suggested that it would be reasonable if gas, water, and other industrial companies were to unite and endeavour to obtain from the Legislature a vote as well as a voice; and he urged the local shareholders to use their votes to get into the Council men who were pledged to economy. With regard to the business of the Company, the sale of gas showed an increase from about 183¾ million to 196 million cubic feet, or an advance of 6¾ per cent. The make was 11,000 cubic feet per ton, from common Newcastle coal. The price paid for coal showed a falling off from 16s. 4d. to 15s. 8d. per ton. The profit for the half year was £8396; and there was a balance of £23,386 at the credit of profit and loss account after payment of the dividend in August, and other charges. The Directors recommend the payment of dividends for the past six months at the rate of 15 per cent. per annum upon the original and "C" shares and 12 per cent. on the "B" shares. This would absorb £7837, and leave £15,549 to be carried forward. Under these favourable circumstances, the Chairman said the Directors hoped to be able at the August meeting to announce a reduction in the price of gas. The Engineer (Mr. J. Hammond), the Secretary (Mr. J. S. Garrard), and the staff were cordially thanked for their services.

Strengthening Reserve and Renewal Funds at Exeter.

The report which the Directors of the Exeter Gas Company presented to the proprietors at the annual general meeting on Monday last week opened with the statement that the sale of gas in the past year had increased to the extent of nearly 3 million cubic feet; and the accounts accompanying it showed that the revenue from this source amounted to £41,349. Unfortunately, the sum realized for residuals fell off considerably as compared with 1904; but, notwithstanding this, and a reduction of 1d. per 1000 cubic feet in the price of gas, there was an increased profit. The total revenue was £57,164; the expenditure, £45,926—leaving a balance of £11,238 to go to the profit and loss account. An interim dividend was paid for the six months ending the 30th of June; and the balance to be carried forward, subject to the final dividend, was £20,327. The dividends declared were at the rates of 10 and 7 per cent. per annum; and they were accompanied by such additional payment as would reimburse the shareholders the deduction for income-tax. A sum of £2400 was put to a renewal fund for retorts; and £1160 had been placed to the reserve fund. Mr. G. Hardy Harris, the Chairman, in congratulating the shareholders on the prosperous condition of the undertaking, said that the demand for gas increased in spite of the competition of electricity. The Company were absolutely up to date in methods, and the Directors had adopted the latest improvements in manufacture. The advantages of gas over electricity had been fully established, and he had no fear regarding the ability of the Company to hold their own in the future. The report was adopted.

More Gas Sold at Hastings.

The Chairman of the Hastings and St. Leonards Gas Company (Dr. Gray, J.P.), in moving the adoption of the report and accounts at the half-yearly meeting on Thursday, pointed out that it was stated in the former that the net results were satisfactory. They used the word "net" because, though there had been a satisfactory increase in the amount of gas sold and in other respects, the price of residuals they could not consider satisfactory. The transfer from the old works to Glyne meant a reduction, on the one hand, in the cost of material for manufacture; and, on the other, a decrease in the price of gas by a reduction to 2s. 10½d. It also necessitated the revaluation of the works; and the revaluation, seeing that the last was nine years ago, had not unexpectedly resulted in a somewhat increased figure. During the half year, a certain amount of stock was sold by tender; and this resulted in a premium of nearly 30 per cent., which he thought very satisfactory. The increase in the gas sold was over 5 millions, which represented £695. Then there were sundry small increases, making a total increase of £806. On the other hand, they had a decrease in residuals of no less than £975. This set off against the increase in gas sold made a net decrease of £169. In the expenditure, they found a decrease in material for manufacture—coal, &c.—of £939; and if they deducted this from the falling off of residuals, £975, they would see that the decreases came within £36. Notwithstanding all this, the decrease in coke (£1169) was a serious item. At the conclusion of the ordinary meeting, a Wharncliffe meeting was held for the purpose of obtaining the assent of the proprietors to the promotion of the Bill to secure relief from the sulphur restrictions. The Chairman having fully explained the position of affairs, Mr. C. E. Botley, the Engineer, said that if the Bill passed, there would be no alteration in the quality of the gas as far as the consumers were concerned. The quantity of sulphur was infinitesimal—only 25 grains in 100 cubic feet of gas, or 1 grain to 1000 grains of gas. They had never been prosecuted; but there had been occasions when it had been unavoidably above the mark. Torquay, Ventnor, and Bournemouth, where consumptives and invalids went, had not these restrictions. The resolution was carried unanimously.

A Small Decrease in Business at Hertford.

Some compliments with regard to his management were paid to Mr. H. D. Duesbury at the recent annual meeting of the Hertford Gas Company. The Chairman (Mr. E. Manser) said there had been a small decrease of business, not quite so much gas being made as during the previous year—in fact, to the amount of £160. Notwithstanding that £17 10s. less was received from public lighting, there had been a few more public lamps. This arose through the Company making an offer to the Corporation to light the lamps at a rather less price than formerly. The amount of rentals for meters was somewhat diminished; but there was an increase on stoves and fittings, which was a healthy sign. With respect to residual products, there was a drop of £180, principally through coke having gone down considerably in price; but notwithstanding this, the net profit came out within about £20 of last year, which was the best one they ever had. The manufacture of gas had been exceedingly satisfactory; and it redounded very much to the credit of Mr. Duesbury that he had kept the working expenses down, and worked the plant in so economical a manner that, with a somewhat smaller income, they made as much profit. He thought he must claim that it had been a very satisfactory year's working. Mr. Gilbertson, also, in seconding the motion for the adoption of the report and accounts, agreed that great credit was due to the Manager for the exceedingly good year's working. The Company are paying their maximum dividend.

Increased Gas Supply in North London Suburbs.

The Directors of the North Middlesex Gas Company reported, at the half-yearly general meeting last Wednesday, an increase of 8,473,500 cubic feet, or 12·8 per cent., in the sale of gas in the latter half of the past year, as compared with the corresponding period of 1904; and the accounts accompanying the report afforded evidence of the continued progress of the Company's undertaking. The revenue amounted to £16,168, and the expenditure to £12,234; leaving a balance of £3934 to go to the profit and loss account. The sum available for distribution was £5442; and it was used in the payment of dividends at the rates of 5, 10, and 7 per cent. per annum on the preference, original, and additional capital, and the augmentation of the reserve fund by £473. There was left a balance of £2019 to the credit of the profit and loss account. The Directors reported that further progress was being made (under the supervision of Mr. L. Trewby, the Company's Engineer) with the renewal of the works. The next day another satisfactory report was submitted by the Directors at the half-yearly meeting of the Southgate and District Gas Company. In their case, the increase in the sale of gas in the latter half of last year, as compared with the corresponding period of 1904, was 3,800,900 cubic feet, or 7·1 per cent.; while the receipts from residuals were also larger. The total revenue was £12,888, and the expenditure £9808; leaving a balance of £3080 to go to the profit and loss account. There was a disposable balance of £3904; and dividends at the rates of 5, 10, and 7 per cent. per annum were declared on the preference, original, and additional capital, as in the case of the neighbouring Company. These took £2395, which left £1509 to be carried forward.

Portsea Island Company's New Works.

The report submitted at the half-yearly meeting of the Portsea Island Gaslight Company stated that the new works at Hilsea had been in operation since Oct. 28 last, and the working results had afforded every satisfaction. The revenue for the six months to Dec. 31 amounted to £102,562; and the expenditure of £81,997 permitted £20,563 to be carried to the profit and loss account, as compared with £18,812 in the corresponding period of the previous year. The quantity of gas made was 665,346,000 cubic feet (an increase of 15,697,000 cubic feet). In the manufacture, 50,591 tons of coal and 494,769 gallons of oil were used, as against 49,212 tons of coal and 492,999 gallons of oil in the corresponding period of 1904. In moving the adoption of the report, the Chairman (Alderman Sir John Baker, M.P.) congratulated the shareholders on the Company's continued prosperity; stating that in 1904 the consumers numbered 32,415, while in 1905 they had risen to 34,833. The appreciation of the incandescent form of lighting by gas became more and more apparent. Though

the past year had suffered greatly from depression in many ways, they, as a Company, he was glad to say, had nothing of which to complain. Their new works, now nearly completed, were satisfactory both to the Engineer (Mr. J. D. Ashworth) and to the Board; and there was no idea that any increase of capital on their account would be required, though perhaps another £10,000 would have to be spent upon them. He had no hesitation in saying that they would eventually possess works which would be inferior to none, and superior to most others. The report was adopted, and a donation of £50 was voted to the Royal Portsmouth Hospital.

Satisfactory Position at Reading.

The report submitted at the recent annual meeting of the Reading Gas Company stated that the net revenue for the year ending Dec. 31, after deducting interest charges and the interim dividends, amounted to £10,663. The Directors recommended the usual dividends upon the preference shares and ordinary stock of the Company, less income-tax, for the past half year, that £3700 be transferred to the reserve fund, and that the surplus of £738 be carried forward to the next account. The quantity of gas sold during the year showed an increase of 7,720,199 cubic feet over that for 1904. The number of consumers continues to grow rapidly; 1244 having been added during the year, bringing the total up to 12,808. Five years ago the number was 5046. In addition to the £20,000 of ordinary stock mentioned in the previous report as having been sold early in the year, the Directors found it necessary to raise further capital. This was done by offering for sale by tender £10,000 of ordinary stock. The amount tendered for was £44,165; and the average price realized was again higher than that of any previous sale of this stock. The large extensions at the works referred to in the report for 1904 (for the payment of which the capital raised during the year was chiefly required) have been brought into successful operation, and have already effected considerable economies in the cost of manufacture. The extensions include a complete oil-gas installation, erected to the designs and under the able supervision of the Company's Engineer and Manager (Mr. Douglas H. Helps). The plant was put into use in July; and the results obtained have been fully equal to those anticipated. Business was begun in the new central offices and show-rooms in May. The premises have proved to be in every way well adapted for their purpose; and being built substantially, and with a due regard to architectural effect, they are an addition to the appearance of the town. In order to encourage the use of gas for motive power, the Directors decided, as from Midsummer last, to make a considerable reduction in the price of gas used by engines. In view of the satisfactory state of the Company's position, the Directors have resolved to reduce the charges for gas, full details of which will be announced to the consumers in due course. The report concluded with some references to the sulphur clauses and the Bill being promoted, by the Reading Gas Company among others, to obtain relief in this respect.

Purification by Lime at Richmond.

The Richmond Gas Company is one of those who are seeking to be relieved of the burden of the sulphur restrictions; and at the close of the ordinary half-yearly meeting, an extraordinary meeting was held to approve of the Bill being promoted with this object. The Chairman (Mr. T. J. Carless) claimed that what was reasonable for 670 other works could not be harmful there, and he was at a loss to understand the opposition of the Richmond Corporation. He thought they should rather have done all in their power, as the London County Council had done, to encourage the production of gas as cheaply as possible—the major benefit of which would go to the consumers under the sliding-scale, to say nothing of ridding the district of the nuisance caused by the use of lime. The Bill was agreed to. Speaking previous to this on the report and balance-sheet, the Chairman said that coals had cost somewhat less—due both to a reduction in price and a higher yield of gas per ton, the carbonizing returns for the last half year having been very satisfactory, and a good way ahead of what were regarded as normal figures. Purification had cost more, owing to the desire of the Company to keep well within the limits of the Act; but he thought the money had been thrown away. There was a small reduction in wages, though a larger quantity of gas had been produced. This was very satisfactory, and was due to the more extended use of regenerative retort-settings. The receipts for gas showed a slight increase, which, taking into account the mild weather experienced during the early winter, was a matter for congratulation. The more extended use of incandescent burners, too, had seriously affected the consumption; but it was a blessing in disguise, as the mantle produced a light that could not at present be beaten, and had given them the means of ousting electricity. Residual products showed lower returns, due to a fall in values; but with a rising coal market they looked for better times. In regard to the profit and loss account, they had made their dividend and something to spare, and were enabled to carry forward an increased balance. A vote of thanks to the staff was responded to by Mr. Thomas May, the Engineer and Secretary.

Steady Expansion at Tunbridge Wells.

In moving the adoption of the report at the annual meeting of the Tunbridge Wells Gas Company, the Chairman (Mr. W. H. Delves) said the year that had just closed had been one of progress, not very rapid, but the weather, upon which all gas companies depended for their increase of business, had been of a mild character. They had increased their number of customers by just over 200; and for a Company which had been in existence for over 60 years, this was a very tolerable record. The town was saturated with gas consumers; and except where new houses were built, there was but little chance of getting new customers. They had increased the quantity of gas sold by 3¾ million cubic feet, producing about £500. The increase in the gas consumed was 1½ per cent. above the previous year. In dealing with the accounts, he pointed out that the capital account remained very much as it was; they had only spent £471. It was a curious thing that in the last three years the net increase of capital was only £1154. This was a record of which they might feel proud; and it showed that they had not overburdened their capital account during that period. Coal had cost 15s. 4d. a ton, whereas last year it was 15s. 3d. They had, however, sold 320 feet of gas more per ton of coal than in 1904; so that though coal had cost them 1d. more, the outlay had really been considerably less. The total gas manufactured, including cost of materials, salaries, carbonizing material, &c., cost less by £106, which was again satisfactory. Distribution had also cost less by £735. This was not a consequence of any undue economy, for the works had been kept in a good state of repair. The cost of repairs, maintenance, and renewal of mains amounted to £2227, as compared with £2741 in the previous year. This decrease was partly accounted for by the fact that they had not been able to do all the work they had laid themselves out to do. The total decrease on the debit side of the revenue account was £1790; and this partly arose from the omission this time of a sum they charged last year for the reconstruction of plant for producing sulphate of ammonia. This he regarded as a profitable outlay, as was proved by the fact that though 850 tons less coal had been used, they had actually manufactured 25 tons more sulphate. Not only had the new apparatus produced more sulphate per ton of coal, but also at less expenditure. The sale of gas produced less this year than it had done last by about £1500. The reduction of 2d. per 1000 feet, however, really lost to them £2000 or more. The residuals showed a decrease of £1267. The total result of the balance-sheet showed a reduction in the profit of £936; but considering the reduction in price meant £2000 less for gas, they might congratulate themselves that they were able to produce a balance-sheet showing no greater reduction in profit. They were enabled not only to pay the increased dividend which was due, owing to the reduction in the price of gas, but to add the considerable sum of about £667 to the balance carried forward. Although the consumer had got a reduction of £2000 in the price of gas, the shareholders benefited by £605 in dividend; so that it was a partnership between the consumers and shareholders, with the advantage of the partnership on the side of the consumers. Taking it altogether, he thought it was a balance-sheet of which the Company might well feel proud. Among the votes of thanks, the services of the Engineer (Mr. A. Dougall) and the Secretary (Mr. C. F. Catt) were cordially acknowledged.

Good Business and Reduced Price at Tynemouth.

The Chairman of the Tynemouth Gas Company (Mr. J. B. Williamson) had an excellent report to submit for the shareholders' adoption at the annual meeting on the 26th ult. The revenue for the twelve months ending Dec. 31 last was £62,760, and the expenditure £52,007; leaving a balance of £10,753. This sum, added to the amount of undivided profits, made a total of £20,893, which the Directors proposed to deal with as follows: Payment of dividends at the rate of 5 per cent. per annum on the consolidated and new ordinary stock (less income-tax), £8813; and of a half-year's dividend on the 4 per cent. preference stock, £285; addition to the reserve fund, £2000; making together £11,098, and leaving a balance of £9795 to be carried forward. There was an increase of 21,269,800 cubic feet, or 5·11 per cent., in the make of gas last year; while 1064 additional meters were put in—bringing up the number to 15,584. The amount received for gas was £1384 more than in 1904; and this has induced the Directors to make a further reduction of 1d. per 1000 cubic feet in the price to all consumers, as from the beginning of this year—making it 2s., less discounts varying from 5 to 20 per cent. This is the lowest figure at which gas has ever been sold by the Company. The system adopted, of supervising incandescent burners free of cost, is becoming very popular, as the consumers realize that they get a very superior light for the cost of the mantles. Accompanying the Directors' report was one by the Engineer (Mr. W. Hardie, Assoc.M.Inst.C.E.) to the effect that the plant had all been kept in good order during the year. The Chairman, in moving the adoption of the report, said the reduction made in the price of gas represented a gain of £1637 to the consumers. There was no doubt that the low price at which it was possible to sell gas, owing to improved methods of manufacture, had given a great fillip to its use, and had enabled the Company not only to hold their own, but to show substantial progress last year. The quantity of coal carbonized last year was 41,767 tons, and it had produced 437,129,400 cubic feet of gas; and the gas made from each ton of coal had increased from 10,315 to 10,477 cubic feet, or 1¼ per cent. The quantity of coke sold per ton had risen from 8·7 to 10·5 cwt. Tar had also increased by 1½ per cent.; and sulphate of ammonia by 12 per cent. If they took the revenue from the sale of residuals over the past three years, they would find it had risen from 71 to 96 per cent. of the total cost of coals and enrichment. Last year they received back for residuals 99·3 per cent. of the cost of coals and enrichment. They had fixed 790 cooking-stoves—an increase of 13·4 per cent.; and there were now 6668 in use. This meant that they were used by three out of every seven of the consumers. The larger proportion were penny-in-the-slot stoves; and the value of this system was shown by the fact that £14,277 was collected from them—all in pennies. The actual weight of the copper collected during the year exceeded 26 tons; and were it not for an ingenious counting-machine devised by the Secretary (Mr. J. J. Carr) which packed the copper into 5s. parcels, the work of counting would have been very laborious indeed. The report was adopted, and the dividends proposed by the Directors were declared.

Incandescent Gas Lighting Appreciated at Wellingborough.

Though the business of the Wellingborough Gas Company, Limited, presented an unusual feature in the past half year, inasmuch as it did not show any increase, owing to the continual depression of trade and the exceptionally mild season, the results of the working were stated by the Directors, in the report they presented at the general meeting on the 26th ult., to have been entirely satisfactory. There was a revenue of £12,474, and an expenditure of £9135; leaving £3339 to go to the profit and loss account. A dividend of 6 per cent. was declared on the "A" and "B" shares, and of 4½ per cent. on the "C" shares (income-tax paid), for the half year. The Directors expressed their pleasure—and it will certainly be shared by their Engineer and Manager, Mr. John T. Lewis—in reporting that the Company have secured the contract for the whole of the public lighting of the town by incandescent gas-lamps for a period of seven years.

A Higher Dividend and Lower Price at Wisbech.

The report which was submitted at the recent half-yearly meeting of the Wisbech Lighting Company must have proved satisfactory reading for both shareholders and consumers—there having been an

increase of 2d. per 1000 cubic feet in the price of gas, as from Jan. 1, with a consequent addition to the dividend. The Chairman (Mr. J. Cockett, J.P.) said they had every reason to be satisfied with the state of things as shown by the report. To be able to take something off the price of gas, and to give a little more to the shareholders, proved that they must have been doing pretty well. The weather had been rather against them for a large consumption of gas. There had not been nearly so much used for heating purposes; and the amount consumed barely reached the corresponding period of the previous year. The 2d. that had been taken off the price of gas to private consumers agreed with the 5 per cent. that was deducted from the public lights. When it was reckoned up, they saw they would reduce the price of gas during the year; and they thought they had best give the Corporation and the ratepayers—for they represented the ratepayers—the benefit that would be likely to come. So they were now all level, and had relatively the same price. Public lights had, of course, always been supplied a little cheaper than private consumers; but the proportion was the same as it has been for years. The plant, he believed, had never been in such a good state as last year. A great deal of money had been spent; but they were getting better gas made at somewhat cheaper rates, counterbalancing what they had to pay in the shape of interest on capital. The Manager (Mr. J. G. Hawkins) was anxious to make the gas as pure as he could, and as cheap as he could.

Wolverhampton and the Sulphur Restrictions.

The half-yearly meeting of the Wolverhampton Gas Company was held last Tuesday; the Directors reporting a net profit of £9118. This amount, added to the balance brought forward, enabled the Board to recommend dividends at the same rate as in the previous year—viz., 3 per cent. upon the preference stock, 5⅛ per cent. upon the consolidated stock, and 3⅛ per cent. upon the new ordinary stock (less income-tax). The balance of the excess dividend undivided—£459—was to be carried to the reserve fund. The Chairman (Mr. B. O. Clark), in moving the adoption of the balance-sheet, said that it was in every way satisfactory. During the year the Company had put in 1562 slot meters and 1416 slot cookers. The report was adopted; and afterwards a special meeting was held to consider the sulphur clauses Bill which is to be introduced into Parliament during the coming session. The Solicitor (Mr. John Neve) explained the circumstances under which the Bill was being promoted; and in answer to a question, he said that probably the Wolverhampton Gas Company's share of the costs would be about £100, though this, of course, would depend upon the opposition. After some discussion the Bill was approved.

Water.

Further Capital for Gosport.

The Gosport Water Company held their annual general meeting last Wednesday, under the chairmanship of Mr. W. E. Churcher, who said that the report which had been sent round was a record of substantial progress, and was the best which he had had in his experience. The receipts for the half year had been £4395, of which £2621 was carried to the profit and loss account, bringing it up to £6475—the largest balance ever known in the Company. In the course of the year the water-rentals had amounted to £8637, which was an increase of £482. As to their new works at Sobertons, good progress was being made; and an abundant yield of pure water was available, which he hoped within the year would be in course of distribution. They believed they already had sufficient water to meet all the requirements of the estimated population of the Company's statutory area in 1921; and this yield could be further augmented at no great additional outlay. The report having been adopted, a short discussion took place on the proposal to raise additional capital in the shape of £20,000 of 5 per cent. preference stock, at the fixed price of £10 10s. per £10 of stock. The Chairman said they believed the money would be easily obtained.

Ample Stores of Water at Newcastle.

The position of the Newcastle and Gateshead Water Company, as disclosed by the Chairman (Mr. W. D. Cruddas), in moving the adoption of the Directors' report at the annual meeting last Tuesday, must have given much satisfaction to the proprietors. Recapitulating the particulars furnished in the report and accounts, he said the revenue was £178,903, against £174,166 in 1904; showing an increase of £4737. The latter figure consisted of the following three increases: £2835 on domestic rentals; £1884 on the manufacturing accounts, supplies by meter, &c.; and £16 in miscellaneous receipts. The total number of tenants at present was about 114,000. The working charges during the year showed an increase of £1570, which, at the first glance, was not very satisfactory. There was a large increase in rates and taxes amounting to £1472; and he was sorry to add that this charge seemed likely to become heavier. As to the appropriation of profit, the balance was £139,338, against £136,172. This, added to the amount brought forward, made the divisible profit £141,210. The interim dividends, &c., came to £80,730, which left £60,480. It was proposed to pay a dividend on the ordinary stock for the half year at the rate of 8¼ per cent. per annum; and on stock under the Acts of 1876 and 1898 at the rate of £5 15s. 6d. per cent.—making £7 12s. 6d. and £5 6s. 9d. respectively for the year. There would then be a balance of £2235 to be carried forward. The capital expenditure amounted to £65,264. This was principally on work at the Catcleugh reservoir, the Whittington tunnel and aqueduct, &c.; while there was a considerable amount spent on a new 24-inch main, to provide an increased supply of water in the newly incorporated districts. At the last annual meeting, the reservoirs, following an exceptionally dry winter, were only about two-thirds full; and considering that this was the time of the year when all were expected to be quite full, he thought it desirable to warn the consumers as to the use of water. Eventually, rain came in March and April, and the Company were able, in a dry summer and autumn, to give a full and constant supply, without any restrictions, to all the consumers. The Catcleugh reservoir had been filled; and the others were nearly full. The Directors were therefore free from anxiety as to their ability to meet any possible demand for a greater supply of water; and he thought the shareholders were to be congratulated upon the excellent position the Company now held. The waste department showed a very satisfactory result; the total consumption of water per head of the population having been again less during the past year than hitherto. This saving was very beneficial to the Company, in assisting them to postpone further capital expenditure. The better class of fittings had also been an advantage, by lessening the annoyance of burst pipes and leakage. The report was adopted, and the dividends proposed were declared. Authority was then given to the Directors to raise £240,000 by the issue of 5 per cent. preference stock, and to borrow by the issue of debenture stock.

SOUTH STAFFORDSHIRE MOND GAS COMPANY.

Mr. G. Macpherson (the Chairman), in moving the adoption of the report—*ante*, p. 439—at the annual meeting of the South Staffordshire Mond Gas Company last week, said that when they met last year, the shareholders saw some of the machinery at the works in motion; but they did not actually begin to deliver gas until April. It was essential that the Directors should convince manufacturers that they could guarantee a continuous supply, so they had to manufacture the gas with only a few customers to take it. They had therefore either to make the gas and burn it for no purpose, or else find some firm who would use it in sufficiently large quantities and purchase it at a low price. They were fortunate enough to make such an arrangement with the South Staffordshire Mines Drainage Commissioners, who allowed them to vary the supply or cut it off entirely. Consequently, as their customers increased, they could reduce the supply to the Commissioners. The value of Mond gas had been clearly demonstrated, as one customer had engines aggregating nearly 1000-horse power running most satisfactorily.

Mr. Alfred Mond, who seconded, said that it was satisfactory to know that the central station had not stopped working since it started. There was no earthly reason why shareholders should throw their shares away. The Directors were most anxious that the Company should be made a commercial success. He was told by some people that the Company could not burn local fuel; but the fact was they had been burning it ever since they started. They could not say at what rate of speed their customers would come; for England was a conservative nation, and slow to make changes.

Mr. Fowkes said he was bitterly disappointed at the balance-sheet. The sale of the gas, he remarked, amounted to £3278, and that of residuals to £4486. The coal in stock figured at £290, and residuals at £272—making a grand total of £8328. On the other hand, they had paid for coal £7894, and for water £1030; and this, with another small item, made a total of £8924—representing a loss of £596. This being so, how could they hope to improve their position next year? Then wages and gratuities amounted to £3115 in the manufacturing department, and £191 in the distribution department—a total of £3306. The higher officials got £1934, which, with establishment charges of £497, made a total of £2500 paid to the staff. Could they afford to pay so much for unproductive labour? Then he noticed £1563 was put down for repairs in a single year, and that for a new plant. The position was a most serious one. In answer to questions, the Chairman said it was not in the interests of the Company to state the price at which they were under contract to sell gas to the Mines Drainage Commissioners. They had about a dozen customers at present. The Managing-Director received £1000 a year salary, and was entitled to do other work. So far as the staff was concerned, they were compelled to have the best men they could get. A shareholder asked why it was that they sold gas for power to other firms and burnt slack under their own boilers, instead of using the gas on the spot. The Chairman replied that their own boilers were constructed for slack, and it was therefore more economical. It was better for them to sell gas at a profit than burn it themselves. The Shareholder: Then it is more economical to burn slack? The Chairman: Yes.

The report was adopted.

Gas Profits at Burnley.—The Burnley Gas Committee estimate that they will have a surplus at the end of the present year of £11,059, which will go to the relief of the rates. During the coming year important works are to be carried out, including the erection of a new retort-house, in respect of which the Corporation have already secured borrowing powers for £23,000. The Committee, who have recently obtained the consent of the township of Hapton to supply it with gas, are about to commence extending the mains thereto, at an expenditure of £2300.

Gas Profits at Belfast.—In submitting the minutes of the Gas Committee which were adopted at last Thursday's meeting of the Belfast City Council, Mr. Doran said that but for the handing over by the Committee during the last few years of the large sum of £93,146, their rates would have been 5d. in the pound more. He might mention that in 1902-3 they made grants in aid of rates of £15,000 and to the new City Hall £4361—making £19,361, or equal to a rate in the pound of 4·55d. In 1903-4, they granted towards the rates £18,763, and the new City Hall £5378—making a total of £24,142, or equal to 5·55d. in the pound. In 1904-5, they granted in aid of rates £15,000, and the new City Hall, £6443; the library sites, £3000; and the Victoria Park £1000—making a total of £25,443, or equal to 5·72d. In 1905-6, they made grants in aid of rates, £15,000; the new City Hall, £8499; library fund, £500; Woodvale Park, £100; and Victoria Park, £100—making a total of £24,199, or equal to 5·38d. The grand total was £93,146; being an average per annum of £23,286, or equal to a rate in the pound of 5 30d. Indeed, the Committee did nothing but give money all the time. Mr. Barkley objected to grants being made by the Committee. He could not see the force of making money out of a definite number of people for the benefit of people who paid no taxes. The Lord Mayor, however, said he could not agree with Mr. Barkley. He thought it was a great thing to have the Gas Department, from which they could get money for relief of the rates.

GAS, WATER, AND GENERAL INVESTMENT TRUST.

The report presented at the Annual Meeting last Friday of the Gas, Water, and General Investment Trust stated that the net revenue for the year ended Jan. 28 last, after making provision for interest on debenture stock and all expenses, and after placing £1500 to reserve for contingencies, amounted to £14,385. To this had to be added the balance of £13,208 brought forward from the previous year's account, giving a total of £27,593. An interim dividend was paid for the half year to July 28 at the rate of 4½ per cent. per annum on the preferred stock, amounting to £7182; and the Directors recommended the appropriation of a further like sum to the payment of a similar dividend for the last six months of the year. This would leave a balance of £13,229 to be carried forward to next year's account. The profit on sales during the twelve months amounted to £7415; and after deducting the losses realized, the balance had been applied to writing down the original cost of certain securities. There had been credited to suspense account the sum of £581 received from the sale during the year of a portion of the securities specially reserved for the credit of that account.

In moving the adoption of the report and the accounts which accompanied it, the Chairman (Mr. J. B. Braithwaite) said that the past year had been a comparatively uneventful one, so far as the Trust was concerned, and there was little to call for remark as regarded the balance-sheet—that was to say, there were but few changes in the figures. The capital account had not altered, and loans from bankers and brokers were approximately the same. On the credit side, the investments were £915,576, as compared with £920,910 in the previous year. Loans were £73,999, against £69,306. The next two items—participations in syndicates and the suspense account for the adjustment of securities—were slightly less; while the remaining ones were very much the same as before. The total figure on each side of the balance-sheet was £1,298,453, compared with £1,290,250 twelve months ago. With regard to the suspense account, they had in the previous year added considerably to it by writing-down securities; and they thought they had provided for all important depreciation, and that the difference between profits on sales and losses on sales would be sufficient for anything further that might be required. In the past year the profit on securities realized was £7415, and the loss £2374; and the Directors had applied the difference of £5040 to writing-down various investments. Reckoning the £581 received from the sale of securities specially reserved for the credit of the suspense account, this account now stood at £261,627, instead of £262,208. The gross revenue was £38,753, against £36,890—or an improvement of about £2000. On the other side, the expenses were pretty much the same as on the last occasion. They were putting aside as a reserve for contingencies £1500, paying the same dividend as for 1904, and raising the carry-forward to a very slight extent—the figure being £13,229, instead of £13,208. That was to say, they were practically putting the surplus revenue earned during the year to the reserve for contingencies, while leaving the reserve account for the equalization of dividend as before. Adding the last-named amount (£4072) to the carry-forward, they were in reality carrying forward £17,300, which was about £3000 more than a year's dividend on the preferred stock. It would be seen that, so far as the revenue was concerned, the Trust had done a little better, though not very much. As to the valuation of securities, they came out a little higher than last year. There was then an appreciation of £6049; while this time the appreciation was £9416, or an improvement of over £3000. They had realized during the past year on revenue account a certain quantity of securities, amounting to £11,520. This compared with £300 for the previous year; so that there was an improvement of about £11,300 here, which, however, did not show in the present accounts. Among the investments of the Trust, £358,544 was in gas and electricity concerns, and £41,675 in water. As to the two undertakings in which the Trust were very largely interested, it would not be well to say much about one—the United Railway and Trading Company—because the Board had been approached and negotiations were pending for the sale of the property. With regard to the Utah Light and Railway Company, the progress of this concern continued satisfactory. The earnings for 1905 amounted to $1,353,362, against $1,265,803 for the previous year. The operating expenses had been $538,400. In addition to this, there had been charged to maintenance and general expenses considerable sums, making a total of $845,729: leaving a net revenue of $507,632. Bonded interest and taxes absorbed $376,165, leaving a surplus of $131,476. It had, however, been decided, for a period of years, to apply out of the net earnings a large sum annually to the improvement of the property; and after making this provision on the present occasion they would be left with a surplus of a little over $100,000, which would admit of the payment of a dividend of 2½ per cent. on the preferred stock, as compared with 2 per cent. for 1904.

The report was adopted; and in acknowledging a subsequent vote of thanks, the Chairman remarked that it might seem to some that the Trust was not making so much progress towards recovery as some of the other Trusts. This, however, was owing to the peculiar circumstances of the case—such a large proportion of their money being spread over very few holdings, which, when they were realizable, would be realizable all together.

The report to be submitted at the meeting next Thursday of John Wright and Eagle Range, Limited, states that the profit for the year 1905, after providing for contingent reserve and charging Directors' fees, Managing-Directors' remuneration, and depreciation on the buildings and plant, amounts to the sum of £54,785. After adding the balance (£9974) brought forward from last year, and deducting the interim dividends (£17,947) paid in August last, there remains at disposal the sum of £46,811, which the Directors recommend be appropriated as follows: To pay a dividend at the rate of 6 per cent. per annum for the half year on the preference shares, less income tax, £2422; to pay a dividend of 2s. 6d. per share on the ordinary shares, free of income-tax, £25,875; to carry to reserve fund, £10,000; and to carry forward to next year, £8514.

READING AND THE SULPHUR QUESTION.

The opponents of the Bill promoted by the Reading and other Gas Companies, relating to the restriction of sulphur compounds, having been already beaten in their attempt to induce the Corporation to oppose the Bill, took another line at Thursday's meeting of the Town Council. Mr. Bonny had given notice of a resolution to the effect that the Members of Parliament for the Borough of Reading, and for the Eastern and Southern Divisions of the County of Berks, be requested to oppose the Bill by every means in their power. The matter, however, only came up at the fag-end of the meeting, and was not discussed on its merits.

Mr. Bonny, in proposing the resolution, said that, as the Council would remember, they decided by a majority of something like nine-tenths to oppose the Bill; but unfortunately they had not a sufficient number present to make the majority of the whole Council that was required. The only thing they could do now was to ask the Members of Parliament to oppose the Bill. He would suggest that if this resolution were carried, the Town Clerk should give the gentlemen mentioned the reasons why they brought it forward in this form.

The motion having been seconded, Mr. Parfitt said it was not a correct statement that nine-tenths of the Council were in favour of opposing the Bill. There was not even a bare majority of the whole Council in favour. The "contrary" was not put, because there were not sufficient members voting to carry the motion. Mr. Bull—who subsequently voted for the resolution of Mr. Bonny—showed the absurdity of the whole proceeding by remarking: "I hope the Council will not take this seriously. We have 1d. reduction in our gas, and that is all we care about."

The resolution was then put to the vote and carried by 12 to 7. The Corporation numbers 40 members.

THE SULPHUR QUESTION AT HASTINGS.

Council Decide not to Oppose the Bill.

At the Meeting of the Hastings Town Council on Friday, the Public Lighting Committee recommended the Council to take no further action in the matter of opposing the Gas Companies (Removal of Sulphur Restrictions) Bill, which the Hastings Gas Company are promoting jointly with others. Alderman Parker mentioned that the Committee were practically unanimous in their recommendation. He pointed out that since the Council filed the petition, Hull, Norwich, Reading, and Tunbridge Wells had all withdrawn from their opposition; and though this did not altogether influence the Committee in their decision, it was thought better not to risk such a great amount of expense.

Mr. Paulson advocated opposing the Bill in question on the ground that the Medical Officer had told them of the bad results of the sulphur. Therefore they were justified in taking steps to protect those who cared anything for their health. Mr. Collins thought that it was a very serious matter not opposing the Bill, especially now the penny-in-the-slot system was so much in use. There would be more sulphur in the gas than there was now. They might perhaps get their gas cheaper; but it would do them more harm. Mr. March suggested that, instead of dropping the opposition to the Bill, Hastings should join the other towns, and that each should contribute towards the expenses. By this means they would avoid taking upon themselves the responsibility of such a large expenditure of money in opposing the Bill. Alderman Langham alluded to the insertion of the clause in the Gas Act of 1883, which, he said, was rather curious in view of the contention now made that sulphur was not injurious. It was difficult to find which way to vote, though he had read up all the information he could on the subject. In view, however, of the adverse opinion expressed, and the fact that they would have to face a great deal of expenditure, employ counsel, and call expert witnesses, any number of which could be looked for on each side, the game was hardly worth the candle.

Alderman Parker, in reply, pointed out that, since the passing of the Act in 1883, the manufacture of gas had much improved; and the clause Alderman Langham had referred to had not been included in recent Gas Bills. As to the question of injury to health, he had been told by Dr. Wilson that the maximum sulphur in gas was in no way injurious to people.

The recommendation was adopted by 21 votes to 3.

THE PUBLIC LIGHTING OF BRIGHTON.

Is the System "Sufficient and Economical?"

Recent changes in the lighting of the principal thoroughfares in the City of London from electricity to gas, coupled with the fact that constant complaints are received of the lighting of certain streets in Brighton, have (says the "Brighton Gazette") raised serious questions as to whether the local system is sufficient and economical. "With the lighting of our main thoroughfares, there is not much to find fault with beyond excessive cost. Turning to the Corporation accounts, we find that before the municipal undertaking was started, the street lighting cost £9095 per annum. It is now £12,385—an increase of £3290 per annum, or 36 per cent. While admitting that our few main thoroughfares are sufficiently lighted, it is with the many miles of side streets that we have to concern ourselves; and, judging by results, the incandescent electric lamp has proved a lamentable failure for street lighting. The Corporation Electrical Engineer, in his evidence at the recent Local Government Board inquiry, stated that the cost of each 32-candle power glow lamp was £9 16s. per annum. As is well known, the whole of Hove and Aldrington is lighted with incandescent gas-

lamps; and we have taken the trouble to ascertain the cost of these per annum. We are informed that each gas-lamp has an illuminating power of upwards of 100 candles, and that the consumption of gas is less than 4 cubic feet per hour. Working upon these data, we find that the cost per lamp does not exceed £3 per annum, including all charges. Thus, the streets of Hove are brilliantly and uniformly lighted at less than one-third the cost of Brighton. The difference in the efficiency of the two lights can be compared in the neighbourhood of Dyke Road, and more particularly in Goldsmid Road, which is partly lighted by electricity and partly by gas. If, as it appears, the ratepayers of Brighton are paying three times the sum that Hove is spending on their splendid street lighting, and only getting an inferior light, they are paying dearly for their municipal electrical undertaking."

THE PUBLIC LIGHTING OF STANLEY.

After a discussion which has lasted many years, a lighting scheme for Stanley and Outwood has been partially carried out, in the face of great opposition, by the casting-vote of the Chairman of the District Council. The installation, which is giving great satisfaction, has been carried out by the Wakefield Gas Company. The district embraces 14 miles of roads in the townships of Stanley, Outwood, and Wrenthorpe, which will be lighted by Sugg's 14 inch "Windsor" lamps, with incandescent burners consuming 3 feet of gas per hour. The lanterns are attached to the columns by Sugg's cast-iron bases, which contain their patent ball trap-doors, and are lighted by means of Simmance and Abady's torches. The Council ruled out a proposal for lighting the lamps automatically, on the ground of expense. The lamps are placed 60 yards apart on the main roads, and 70 yards apart on the bye-roads. The whole scheme consists of 376 lamps; and orders were given to commence fixing in the middle of January. On Thursday last, 100 lamps were lighted, and brilliantly illuminated the roads; and the Gas Company have now received instructions to have the remainder ready for lighting on Sept. 1. After the lamps had been lighted, an adjournment was made to the Railway Hotel, where, on the invitation of the Chairman of the Council (Mr. Hemingway), dinner was partaken of. Mr. H. Townsend, the Engineer to the Wakefield Gas Company, proposed "Success to the Stanley Urban District Council," congratulating them upon having resolved to light up their district. Mr. Curtis, in responding, thought they might fairly congratulate themselves on having made such a good bargain as they had with the Gas Company.

METROPOLITAN WATER BOARD.

Revision of Charges—Formation of a Law Department.

The Ordinary Meeting of the Board was held on Friday—Sir R. M. Beachcroft in the chair.

The Appeal and Assessment Committee reported that they had had under consideration the question of the revision of the water charges within the Metropolis, as a result of the quinquennial valuation, and, in conjunction therewith, the fact that there is no similar practice in force in respect of water charges outside the Metropolitan area. The Committee pointed out that the Board are not bound by the rateable value fixed by the local authorities outside the Metropolis—the water charges being based upon the net annual value. The Water Companies, in the majority of cases, paid no regard to the local assessments; the values, once fixed by the Companies, being rarely, if ever, disturbed. As a result, in a large number of cases, the charges were based upon a value fixed some time ago, and the consumers were not therefore paying an adequate rate in comparison with those in other parts of the Board's area. The Committee had come to the conclusion that the present time would be favourable for the revision of assessments throughout the whole of the area—some regard being had to the local valuation. To this end they were empowered to expend £1200 in the purchase of the valuation lists of the rating authorities in the area, excluding the Metropolis; it being pointed out that the lists would also be useful in the consideration of the question of the adoption of uniform scales of charges throughout the whole area.

After considerable discussion, the Board approved of a proposal of the Law and Parliamentary Committee, that the legal department of the Board should be severed from that of the Clerk of the Board, and that a Solicitor's Department should be formed under the direction of Mr. Walter Moon, the present Law Clerk. It was proposed to increase Mr. Moon's salary from £500 to £700 per annum; but this matter is still under the consideration of the General Purposes Committee. Among those who opposed the recommendation was Lord Welby, the Chairman of the Finance Committee, who thought that it would be wise to wait until the Board knew how the financial result of the year's work would turn out before approving proposals involving increased expenditure. Mr. Lidiard, who also opposed the proposal, said that already the Board had 110 more officers than there were in the service of the Water Companies.

In the report presented by the Water Examination Committee, they stated that during the month of January their attention was drawn to the condition of the water then being supplied to consumers in certain parts of the Board's area—more especially in the district served from the Southwark and Vauxhall works. The Committee explained that heavy and prolonged rains occurred throughout that month, causing the Thames to be in flood, which necessitated the closing of the intakes, and entailed an excessive demand on the storage capacity of the Board's reservoirs. The Committee were in communication with the Works and Stores Committee on the subject, and understood from the Chief Engineer (Mr. W. B. Bryan, M.Inst.C.E.) that the completion of the reservoirs in course of construction at Apps Court, and of other necessary works in the Thames Valley, would obviate a recurrence of the state of things in question.

A return was presented relating to the supply of water for the month of January. It showed that the total average daily supply was 204,994,000 gallons, while the number of houses supplied was 1,040,686; the total estimated population being 6,774,839. The mean supply per head per day was 30·2 gallons; the figure for the corresponding month of 1905 being 31·2 gallons. The quantity of water in store in impounding reservoirs at the end of the month was 5917 million gallons. There were connected 829 additional supplies; and 5550 yards of mains were laid.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

There was to-day a further hearing in the Second Division of the Court of Session in the action relating to the pollution of the Calton Hill Brewery well, a report of the proceedings of which will be found on p. 665. Nothing more will be heard of the case in Court until the 12th of May.

At the meeting of the Edinburgh and Leith Gas Commissioners on Monday last, the minutes of the Works Committee contained the following ominous statement: "The Committee remitted to the Sub-Committee as to action by Messrs. Jas. Muir and Son, Limited, letter of the 9th inst. from Messrs. Finlay and Wilson, S.S.C., intimating pollution of the 'Brewery' well." The Brewery well is the other well in Messrs. Muir's place. It has not hitherto been polluted; and in order to preserve it from pollution, it has been found desirable to pump the Stable well, so as to draw all the polluting material into it. In fact, in his judgment, Lord Ardwall estimated that it would take ten years for the Stable well to become pure; and he allowed £1040 for the pumping of it during that time. If the Brewery well is now polluted, and it can be brought home to the Gas Commissioners, they will be involved in very serious outlay indeed. This announcement makes the situation much more serious than it has yet been.

At the same meeting of the Commissioners, Bailie Pennell moved the following motion: "So as to allow of any necessary reconsideration of the conditions of employment and emoluments of our officials afternamed, remit to the Finance and Law Committee so that a Sub-Committee, having power to call for such information as is required for that purpose, may bring up report upon the conditions of employment and emoluments of Mr. Herring, our Chief Engineer, Mr. Gibb, our Treasurer, Mr. Cockburn, our Collector, and Mr. Jack, our Clerk." He said the motion committed them to nothing. It merely asked for information. With regard to three of the officials named, 17½ years had elapsed since their appointment, and there was no member of the Commission who was a member when they were appointed. If it were found to be desirable, they could define the duties of the officials clearly. The motion was adopted. Judge Bryson, the Convener of the Works Committee, reported that they had agreed to recommend that the price charged for gas for public lighting be fixed for the ensuing year at 2s. 5d. per 1000 cubic feet for flat-flame burners, and at 2s. for incandescent burners. The recommendation was adopted.

A launch, named the *Dalmuir*, propelled by a gas-engine, was sailed on the Forth and Clyde Canal on Wednesday. The engine used is on the Beardmore-Capitane principle, the working of which, it is claimed, is attended with great economy in fuel, space, and weight. The gas is derived from a producer. Anthracite coal is used, the consumption of which is about 47 lbs. per hour. The engine has four cylinders, of 8¼ inches diameter, and 11 inches stroke; and it works at 300 revolutions per minute. The producer is worked by a petrol-engine, which also starts the main engine. The gas from the producer is cooled in a tower containing water sprays, and then, after being dried, it passes through a mixing-valve, and is sucked into the engine. It is said to be the first vessel propelled by gas in Scotland.

The tenth ordinary general meeting of the Larkhall Gas Company was held last week. There was reported a net balance of profit amounting to £1619. A dividend at the rate of 7½ per cent. was declared; £200 was placed to reserve fund; £500 was set apart to meet expenditure in connection with the extension of the purifiers and lime shed; and £468 was carried forward.

On Thursday, the members of Kilsyth Town Council visited Stirling and Alloa for the purpose of inspecting the sulphate plant in the gas-works in these towns; there being a proposal on foot to erect similar plant in the works at Kilsyth.

Sheriff-Substitute Sym yesterday issued his decision in an action in the Sheriff's Court at Perth, brought by the Corporation against Wm. Wotherspoon, spirit dealer, South Street, in which decree was asked for £4 7s. 2d., being the proportion of the gas consumed in a lamp in a private court beside the defender's property. The account extended back for a period of seven years. The action was brought under section 105 of the Burgh Police (Scotland) Act, of 1892, which gives power to charge the owners of property who have access to their properties from private courts, for the lighting of them. Wotherspoon has the right to use the court for the putting on and off of an outside shutter, and the rain-water conductors upon his property are connected with a drain in the court. These circumstances, it was maintained, constituted access in the sense of the Act. On behalf of Wotherspoon, it was contended that access must mean entrance to the property. The Sheriff-Substitute decided that the section founded on does not warrant the charge; and he has given the defender absolvitor, with expenses.

Sales of Shares.—Mr. S. F. Dugdall sold by auction on Saturday, the 24th ult., 286 5 per cent. preference shares of £10 each, and 200 ordinary 7 per cent. shares of £10 each in the Brixham Gas Company. The preference shares realized from £10 6s. to £10 7s. 6d. each; while the ordinary shares fetched from £10 5s. to £10 7s. 6d. each. At the Bristol Auction Mart, on Thursday week, Messrs. Alexander, Daniel, and Co., sold £15,000 of Bristol Water-Works stock, in lots of £100, at the reserved price of £147. The total realized was £23,046 10s.; the highest price per lot being £154, and the lowest £153. The average was £153 12s. 10d., which was above the average of the last two sales of this kind.

CURRENT SALES OF GAS PRODUCTS.

Week ending March 3.

The London Market for tar products remains steady, but with little business doing, as makers cannot undertake further orders, except to a small extent, for this half year. Stocks of pitch are extremely low, and shipments of this article are brisk. Crude carbolic acid and benzol are inquired for at the last prices, but without finding sellers for prompt delivery. Creosote oil is firm. Sulphate of ammonia is in better demand; and buyers are willing to pay distinctly higher prices than last week.

Sulphate of Ammonia. LIVERPOOL, *March* 3.

Although the tone of the market has improved, prices remain without much alteration. Makers continue to market their output freely; but second-hand parcels, which have been selling below the level of current prices, seem to have been cleared off, so that this element of weakness has been removed. The closing quotations are £12 5s. per ton f.o.b. Hull, £12 6s. 3d. to £12 7s. 6d. per ton f.o.b. Liverpool, and £12 7s. 6d. to £12 8s. 9d. per ton f.o.b. Leith. Towards the close there has been renewed interest in the forward position, and considerable business has resulted. £12 5s. per ton is reported to have been accepted for July-December delivery, f.o.b. East Coast port; while £12 7s. 6d. up to £12 10s. per ton f.o.b. Leith has been paid for best oil makes, delivery April forward. £12 7s. 6d. per ton has also been paid for April-September f.o.b. Liverpool.

Nitrate of Soda.

This article is firmly held in all positions, notwithstanding the reported breakdown in the negotiations for renewing the combination of producers. Spot prices remain 11s. 3d. to 11s. 6d. per cwt., according to quality.

Tar Products. LONDON, *March* 3.

Business has been quiet during the past week, though there has been a fairly good inquiry all round. The depression continues in pitch, though there is a very good inquiry from both South Wales and Belgium. Prices, however, continue to weaken, and sales are reported at very low figures. So far as London is concerned, some of the makers are very firm in their ideas, and decline to offer anything for early delivery; but second-hand sales are reported at under 29s. On the East Coast, 27s. and 27s. 6d. has been accepted for February-June delivery; and there appears to be rather a desire to sell, as contracts are actually reported for September-December at about this figure. Lancashire makers have sold at prices varying from 25s. to 25s. 6d. for early delivery; while sales are reported at 26s. to 26s. 6d. for September-December. In anthracene, the position remains precisely the same, and there is no business to report. Benzol is very quiet; and the demand for 90 per cent. is not at all strong. Business has been done at outports at prices equal to about 9d. per gallon; while sales are reported for home consumption at very low figures for early delivery. In toluol, there is nothing offering. The demand continues good, but prices remain in about the same position. Solvent is still very firm for prompt delivery, and it is very difficult indeed to obtain immediate supplies. Sales are actually reported at 1s. 1d. for ordinary quality; while still higher prices have been paid for special makes. For forward delivery, however, there is certainly more offering, and it is quite uncertain whether existing prices will be maintained. A fairly good business has again been done in carbolic acid at 1s. 9½d. for 60's, at which price there appears to be a steady demand. Consumers, however, still decline to pay 1s. 10d. for July-December, though business is reported in 75's at 2s. 2½d. over this period. In crystals, there is really very little doing. English makers do not appear at all anxious to sell at 6d., and, as a rule, ask 6⅛d. for 39-40 per cent. There is not very much doing in creosote; the demand for export having fallen off slightly during the past week. London makers, however, still ask 1¾d.; but it is reported that business has actually been done in salty oil at 1⅝d. Yorkshire manufacturers have arranged business at 1½d. at their works, though a little less than this has been accepted in some instances for forward delivery. Lancashire makers do not find it easy to realize 1⅛d. per gallon; there being a considerable quantity offering on this market for both prompt and forward delivery.

The average values during the week were: Tar, 17s. 6d. to 21s. Pitch, London, 28s. to 28s. 6d.; east coast, 27s. to 27s. 6d.; west coast, 25s. to 25s. 6d. Benzol, 90 per cent., 9½d.; 50-90 per cent., 10½d. Toluol, 1s. 0½d. to 1s. 1d. Crude naphtha, 4¼d.; solvent naphtha, 1s. 0½d. to 1s. 1d.; heavy naphtha, 11½d. to 1s. Creosote, London, 1⅝d. to 1¾d.; North, 1 7/16d. to 1½d. Heavy oils, 2¼d. Carbolic acid, 60 per cent., 1s. 9½d. Refined naphthalene, £4 10s. to £8 10s.; salts, 20s. to 21s. 6d. Anthracene, "A" quality, 1½d. to 1⅝d.; "B" quality, unsaleable.

Sulphate of Ammonia.

Markets close with a decidedly better tone, and there is certainly more inquiry for both prompt and forward delivery. The Beckton quotation is still nominally £12 15s.; but this is decidedly over the actual market value, which cannot be taken as more than £12 10s. In Hull, business has again been done at £12 5s. for early shipment; while in one instance £12 6s. 3d. is reported to have been paid for March. In Leith, there is still business doing at £12 7s. 6d., at which price it is reported that a fairly large quantity has been placed for early delivery; while in Liverpool £12 6s. 3d. has been paid on one or two occasions, and there appears to be a better inquiry for March delivery.

The Chemical Engineering Company and Wilton's Patent Furnace Company, have received an order, through Messrs. Corbet Woodall and Son, for a complete liquid and anhydrous ammonia plant for the South African Lighting Association.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
American Offices: TORONTO. TELEGRAPHIC ADDRESS: "CARBURETED, LONDON."

CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily
Blackburn	1,250,000	Buffalo, N.Y.	2,000,000	Newcastle-on-Tyne	1,800,000
Windsor St. Works, Birmingham	2,000,000	Winnipeg, Man.	500,000	Leeds	1,800,000
Saltley Works, Birmingham	2,000,000	Colchester (Second Contract)	300,000	Malton	150,000
Colchester	300,000	York	750,000	Smethwick	500,000
Birkenhead	2,250,000	Rochester	500,000	Gravesend	300,000
Swindon (New Swindon Gas Co.)	120,000	Kingston, Ont.	300,000	Pernambuco, Brazil	125,000
Saltley, Birmingham (Second Contract)	2,000,000	Crystal Palace District	2,000,000	Duluth, (Second Contract)	300,000
Windsor St., Birmingham (Second Contract)	2,000,000	Duluth, Minn.	300,000	Leicester (Second Contract)	1,000,000
Halifax	1,000,000	Caterham	150,000	Newport (Second Conttract)	250,000
Toronto	250,000	Leicester	2,000,000	Brockville	250,000
Ottawa	250,000	Enschede, Holland	150,000	Toronto (Third Contract)	750,000
Lindsay (Remodelled)	125,000	Buenos Ayres (River Plate Co.)	700,000	Montreal, Ont. (Second Con.)	1,800,000
Montreal	500,000	Burnley	1,500,000	Toronto (Fourth Contract)	1,000,000
Toronto (2nd Cont., Remodelled)	2,000,000	Kingston-on-Thames	1,750,000	Hamilton, Ont.	400,000
Belleville	250,000	Accrington	500,000	Rochester (Third Contract)	1,600,000
Ottawa (Second Contract)	250,000	Tonbridge	300,000	Leeds (Second Contract)	900,000
Brantford (Remodelled)	200,000	Stretford	500,000	Buenos Ayres (Primitiva Co.)	1,200,000
St. Catherines (Remodelled)	250,000	Oldbury	300,000	Buenos Ayres (New Co.)	1,200,000
Kingston, Pa.	125,000	Todmorden	500,000	Christchurch, N.Z.	300,000
Peterborough, Ont.	250,000	Saltley, Birmingham (Third Contract)	2,000,000	Rochdale	1,600,000
Wilkesbarre, Pa.	750,000	York (Second Contract)	750,000	St. John's, Newfoundland	250,000
St. Catherines (Second Cont.)	250,000	Rochester (Second Contract)	500,000	Brantford (Second Contract)	400,000
		Newport (Mon.)	250,000	Smethwick (Second Contract)	500,000
		Tokio, Japan	1,000,000	Pontypridd	250,000
				Montreal (Third Contract)	1,800,000

And, in addition, COAL GAS PLANTS at NELSON, B.C., CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG.

COAL TRADE REPORTS.

Gas Coal Contracts.

The "Newcastle Daily Chronicle" referring in their issue for the 28th ult. to the subject of gas coal contracts said: "In a very short time, the largest of the contracts for gas coal will be negotiated for—those for the great London Gas Companies. They are of importance both to the coalowners concerned and to shipowners. It is believed that there will be more controversy as to the prices that are to rule than is sometimes the case. The price of coal was very high some years ago; and it has fallen steadily over those years. But last year it certainly changed in its tendency; and the question that is at issue is not whether there shall be an increase in the prices to be paid, but what shall be the extent of that increase. Some of the contracts for supplies for large Continental gas-works have been allotted at prices that show a satisfactory increase, though the exact price left for the coals is a little clouded by the varying estimates that are formed of the sum to be allowed for the freight included in the delivered price. In the contracts now to be considered, there are two facts to be borne in mind. On the one hand, there is the fact that the tendency of prices of the best Durham gas coals is now upwards. The use of the illuminant increases steadily, and with it the consumption of gas coals; while there does not seem to be any great enlargement of the production of the best gas coals. On the other hand, there is a tendency, equally distinct, towards the sale of gas that is not so rich, and that allows of the use of larger quantities of coals that are not quite so rich in gas; so that the area of choice of supplies is a little more extended. How far these considerations will rule in the decision of the separate contracts that are yet to be decided, remains to be seen; but it is probable that—as in many such cases—the result will be a compromise. At present, the position is that of demands that show a large increase in the prices quoted; and of hints at offers that show a very small one. In time, the matter will be settled, and the higgling of the market will measurably determine the prices that have to be paid."

Lancashire Coal Trade.

The demand for house and steam coal still continues in good request. The output from the pits is fully up to the average; and the miners are employed full time. There is no change to report in prices nor in wages. More coal has been going down to the Ship Canal for shipment, owing to the increased requirements by householders for house qualities; and slack is scarce and rather more difficult to get hold of. This difficulty will be increased as the summer weather approaches; so much so, in fact, that some colliery proprietors are already beginning to stock slack in order to be prepared for existing contract requirements. Prices in the summer are almost certain to be increased for this class of fuel. Why present prices remain practically unaltered is owing to the competition of the Yorkshire and Midland counties, and to the fact that a rise in price would assuredly be followed by a more pressing demand upon colliery proprietors for an increase of wages. The total output of coal from the mines of the United Kingdom last year was 236,111,150 tons—an increase of 3,699,366 tons on the output in 1904. The demand for gas coal and cannel is decreasing. Pit prices on the Manchester Coal Exchange are as follow: Superior house coal 13s. 6d. to 14s. 6d., secondary 12s. to 13s., common 9s. to 10s., steam and forge 8s. to 9s., best engine fuel 7s. 6d. to 8s. 6d., best slack 6s. 6d. to 7s. 6d., medium and common 5s. to 6s., shipping coal 9s. to 10s.

Northern Coal Trade.

The coal trade is more active. There is a decided improvement in the demand for some classes of coal, and prices have risen rather sharply, more especially for steam fuels, which fell off a month or so ago and are now recovering. Best Northumbrian steams are 10s. per ton f.o.b., second-class steams are 9s. 6d., and steam smalls are about 6s.—the demand showing an increase, more especially for forward delivery, due in part to the fact that some of those who have taken contracts are now putting them into the market to arrange for the fuel. In the gas coal trade, the demand is still heavy; and some companies seem to be taking full quantities for this season, though the deliveries are less than they were. Prices for Durham gas coals vary, according to quality, from about 8s. 10½d. to 10s. per ton f.o.b. One or two comparatively small contracts have been settled; and in one case for best Durham gas coals about 10s. per ton has been paid for delivery over the shipping season. The larger contracts for the Metropolitan Gas Companies are expected to be soon in the market; and it seems to be the idea that there will be a struggle as to the prices that will rule—the coalowners having received considerable advances on the foreign contracts for gas coals. In coke, prices are firmer; and this, and the lessening output, tends to stiffen the prices of gas coke, which is quoted at about 11s. per ton f.o.b., but some sellers ask higher values.

Scotch Coal Trade.

Trade continues to be very active; the outputs being well taken up. Current prices are, however, not in a buoyant condition. As a matter of fact, they are rather tending to droop. There was a good week's export, which tends to keep down stocks. The prices quoted are: Main 7s. 9d. to 8s. per ton f.o.b. Glasgow, ell 8s. 9d. to 9s. 6d., and splint 9s. 6d. to 9s. 9d. The shipments for the week amounted to 238,236 tons—an increase of 10,130 tons upon the preceding week, and of 20,021 tons upon the same week of last year. For the year to date, the total shipments have been 1,748,424 tons—an increase of 46,080 tons upon the corresponding period of 1905.

An offer having been received from the Block Light Company to supply and fix twelve of their lights and keep them in repair free for a month, the Chelsea Borough Council resolved that the Company should be permitted to place the lights in the lamps in Manresa Road.

NEW CONVEYOR COMPANY, LTD.,

Transport Appliance Works,

SMETHWICK, BIRMINGHAM.

COMPLETE INSTALLATIONS OF RETORTS.

COMPLETE COAL CRUSHING, ELEVATING, AND CONVEYING PLANTS.

COMPLETE HOT & COLD COKE CONVEYING, CRUSHING, AND SCREENING PLANTS.

PLEASE WRITE FOR ESTIMATES.

Telegrams: "Aptitude, Birmingham." **Telephone: 50 Smethwick.**

Wentwood Water Scheme at Newport (Mon.).

The Mayor and Corporation of Newport (Mon.) paid a visit on Monday of last week to the Wentwood reservoir, from which the principal water supply of the borough is derived. The reservoir holds 384 million gallons; and the visitors found it full to overflowing. The Corporation acquired the water undertaking from the Company in the year 1888, for the equivalent of £278,000; and with the concern were transferred the parliamentary powers obtained the previous year by the Company to construct a new reservoir at Wentwood. The scheme is what is known as a flood-water scheme; the drainage area comprising some 1604 acres of land. Water is drawn into the main reservoir from two valleys and two streams, by means of a tunnel nearly 2½ miles long, which has a discharging capacity of 71,600,000 gallons of water a day at the lower end. The embankment, the construction of which was at one time a source of great anxiety to the Corporation, is now firmly established, and can be elevated 3 feet to increase the storage capacity of the reservoir. The capital estimated by the old Company to be required for the completion of the works authorized by Parliament was £120,000; but this was increased, as the scheme proceeded, to the extent of £406,000. In addition to the Wentwood reservoir, Newport has three others; the total capacity of all four being 621,700,000 gallons.

Theft of Gas-Fittings.

At Enfield Police Court last week, six lads were charged with stealing gas-fittings belonging to the Tottenham and Edmonton Gas Company; and John Rose (65), a dealer, was charged with receiving the same, well knowing them to have been stolen. Describing the facts of the case, Mr. Windsor, for the prosecution, stated that Mr. Alger, an estate agent, had the care of premises in Ray's Avenue, Edmonton, which he found had been broken into and dismantled of all the gas-fittings. These were the property of the Gas Company, who hired them out to tenants who find it inconvenient to purchase them. They were initialled "T. & E. G. Co." When the fittings were taken to Rose's shop, they were not wrapped up in any way, but merely placed in a cap. The lads told Rose that they had taken the fittings from off a dust-heap, and without more ado he handed one of them 4d. for goods worth 12s. No doubt these boys would not have committed larceny it they had not known where to go immediately they secured the goods. This form of robbery was so serious that the Company had lost fittings to the value of between £150 and £200 in the course of the year. Rose informed the Bench that he had been in business in the neighbourhood for about 24 years, and had never been charged before. The Magistrates sentenced him to three months' imprisonment; the Chairman styling him "a thorough rogue." One of the boys was remitted to a reformatory for four years, another was sent back to the truant school from which he was out on license, and the others were fined 10s. each.

Scott-Snell Lamps for Bethnal Green.

The Works Committee of the Bethnal Green Borough Council reported last Wednesday that they had had under consideration the advisability of further improving the public lighting of the main roads of the borough. In November last, the Surveyor was instructed to make inquiries with respect to high-pressure and other improved gas systems; and the Committee had visited with him several important thoroughfares in the City and West-end where improved systems of lighting had been installed, and had had before them a detailed report on the subject. The total initial outlay of installing the Scott-Snell lamps (which system the Committee considered the best for their purpose) in the main roads within the area of the Gaslight and Coke Company was £735; and the Company were prepared to carry out the scheme at their own cost in the first instance, and to accept payment in twenty equal quarterly instalments, free of interest, providing that the lighting was entrusted to them under a contract embodying the maintenance terms set out in the scheme for a period of five years. As regards the Commercial Company's area, the Company were not prepared to make any definite offer, but said they would doubtless be willing to enter into a contract later. The best terms submitted were that the Council should bear the initial cost of installation, and recoup the Company the actual cost of gas and maintenance during the first year. The Committee had decided: (1) That Scott-Snell lamps should be installed in the main roads of the Gaslight and Coke Company's area. The present total cost per annum is £409 17s. 3d.; the additional cost per annum during the first five years will be £511 11s. 4d.; and the additional cost per annum afterwards, £346 11s. 4d. (2) That the Commercial Gas Company be asked to light Bethnal Green Road, from Brick Lane to the Shoreditch boundary, with Scott-Snell lamps for one year, at an estimated initial outlay of £104, and an annual cost for gas and maintenance of £104, as against £76 at present.

Tampering with a Gasholder.—It was found last Sunday week that there had been a considerable escape taking place from the Aberdovey Gas-Works, and investigation revealed the fact that the cap at the top of the recently constructed gasholder had been unscrewed, with the result that from 15,000 to 20,000 cubic feet of gas had escaped. It is supposed that the cap was loosened deliberately by some person who climbed up on to the holder; but the author of the heroic deed has not yet proclaimed himself.

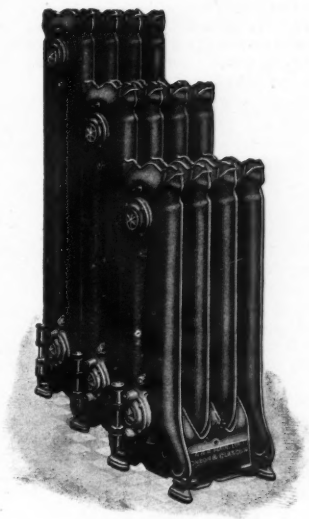
Gas for Power Purposes at Wellingborough.—The Wellingborough Gas Company have given notice that, from the commencement of this year, the following will be the scale of charges for gas used for motive purposes (all subject to an allowance of 2d. per 1000 cubic feet for prompt payment): For a consumption during the month not exceeding 10,000 cubic feet, 2s. 4d. per 1000 cubic feet (2s. 2d. net); from 10,000 to 20,000 cubic feet, 2s. 3d. per 1000 cubic feet (2s. 1d. net); from 20,000 to 40,000 cubic feet, 2s. 2d. per 1000 cubic feet (2s. net); from 40,000 to 80,000 cubic feet, 2s. 1d. per 1000 cubic feet (1s. 11d. net); from 80,000 to 160,000 cubic feet, 2s. per 1000 cubic feet (1s. 10d. net); over 160,000 cubic feet, 1s. 10d. per 1000 cubic feet (1s. 8d. net).

THE "MAIN"

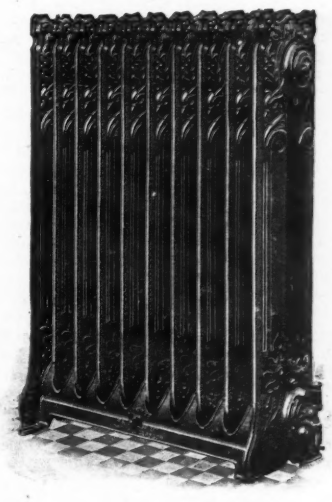
"ST. MUNGO"

Gas-heated

STEAM RADIATORS.



Plain Design.



Ornamental Design.

FITTED WITH EVERY MODERN IMPROVEMENT

Write for Prices.

R. & A. MAIN, LTD.,

LONDON, GLASGOW, & FALKIRK.

Price of Gas at Halifax.—The Halifax Gas Committee have decided to recommend the Town Council to make a reduction of 1d. per 1000 cubic feet in the price of gas for lighting purposes. A charge for gas for power purposes was also fixed, ranging from 1s. 10d. to 1s. 7d., with 1d. per 1000 cubic feet discount for prompt payment.

Incandescent Gas for Lighting Swimming Baths.—The Kensington Borough Council instructed the Lighting Engineer last Tuesday to carry out the necessary alterations in the fittings of the third-class swimming baths preparatory to the installation of incandescent gas lighting, which is to be placed in all the baths under the control of the Council.

Proposed Purchase of the Blyth Water-Works.—The Blyth Urban District Council contemplate the purchase from Lord Ridley of the Blyth Water-Works; and an estimate that has been prepared places the probable cost of acquiring the undertaking at £14,500. The sanction of the Local Government Board is to be asked for the borrowing of £14,000, the repayment to extend over a period of fifty years.

Suicide by Gas.—A South Shields grocer, who had suffered from an affection of the brain for about 20 years, was a few days ago discovered lying in bed dead, with the end of a rubber tube attached to an open gas-cock in his mouth. Death was stated by the doctor who was called in to have been caused by the inhalation of coal gas; and at the inquest the Jury returned a verdict of "Suicide," without expressing any opinion as to the state of deceased's mind.

New Gas-Works at Billingshurst.—Last Wednesday week, the new works of the North Sussex Gas Company, close to Billingshurst Railway Station, were opened by Mr. Charles Wheeler, the Chairman; the occasion being celebrated by a luncheon, at which an appropriate toast list was gone through. It was stated that the engineering work had been carried out by Messrs. Westwood and Wrights; while great assistance had been rendered to the Company by Mr. J. W. Parkes, of the Crowborough Gas Company. Mr. E. D. Sapey, of Horsham, said the plant was a model one; and there was plenty of room for extensions. Everything was well adapted and up-to-date. Mr. A. F. Painter is the Comgany's Manager.

Public Lighting of Coventry.—Whether Coventry should resort to gas for the lighting of the main streets is a matter at present under consideration. Electricity is now employed for this purpose; but at the last meeting of the Council it was urged that gas would be cheaper. Mr. Errington, who is Vice-Chairman of the Electric Light Committee, besides being a member of the Gas Committee, moved for a return to be presented as to the cost of street lighting, with the view to the substitution of gas for electricity. Alderman West, the Chairman of the Electric Light Committee, said the change, if carried out, would mean the scrapping of a quantity of plants. The Council, however, decided to have the required information.

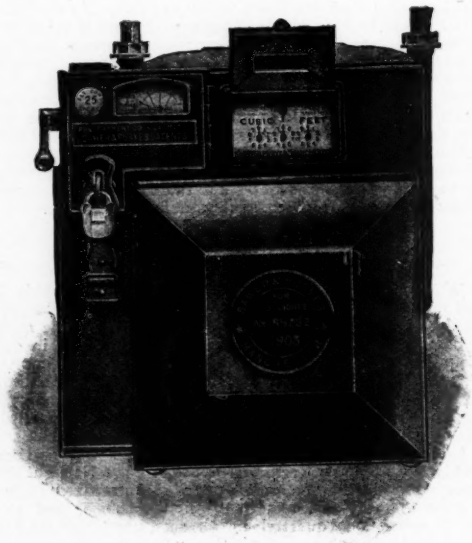
Bradford Gas Finances.—At the meeting of the Gas Committee of the Bradford Corporation on Friday, there was a discussion on the balance-sheet of the department for the year ended March 31, 1905. The point debated was whether, in view of the deficit of £1820 shown in the balance-sheet, the Committee should raise the price of gas or ask that the whole cost of street lighting should be paid out of the rates. Of the total cost of lighting the streets—£30,000—some £26,000 at present comes from the rates. The Committee arrived at no decision; deferring further consideration of the matter until the middle of May. In the meantime, the Engineer (Mr. Charles Wood) is to make inquiries for the guidance of the Committee.

Offering Facilities to Consumers at Holywood (Co. Down).—With a view to increasing their output, the Holywood (Co. Down) Gas Company, Limited, announce that they are prepared to put pipes and fittings into all dwelling houses up to £12 valuation, situated within 30 feet of their present mains, for the sum of 5s. 6d. per house, on the tenant agreeing to become a gas consumer. The fittings will include a service-pipe, meter, gas-brackets in the kitchen and parlour, and a boiling-stove. The Company are also willing to connect a first-class cooking-stove free of cost in all such houses, without any rent for the stove, on condition that at least 8000 cubic feet of gas per annum be used through the stove alone; otherwise the usual hire rate of 4s. per annum will be charged.

Management of the Paris Gas Supply.—The French Minister of the Interior has introduced into the Chamber of Deputies a Bill to sanction the arrangement entered into with the Liquidators of the Paris Gas Company for carrying on the supply during the present year, and to authorize the raising of a loan of 105,000,000 frs. to meet the expenses. Of this sum, 90,000,000 frs. will be needed to pay the Liquidators the amount of the Company's share of the property at the expiration of the concession on Dec. 31 last. The outlay attending the transfer is put down at 12,500,000 frs.; and the raising of the loan is estimated to cost 2,500,000 frs. The loan will be repayable in fifty years; and, reckoning the interest at 3·6 per cent., it will cost about 4,536,000 frs. per annum. It will, of course, be fully guaranteed by the profits realized on the gas undertaking.

New Joint-Stock Companies.—The Hygienic Stove Company, Limited, has been registered with a capital of £5000, in £1 shares, to take over the business carried on by J. F. Gibbs as the Hygienic Stove and Apparatus Company, in High Holborn, and to carry on the business of patentees, manufacturers, and vendors of gas cooking-ranges, gas-fires and stoves, boiling-burners, and other gas, electrical, or other stoves and appliances, &c. There is to be no initial public issue. The Pneumatic Gas Lighting Company, Limited, has been registered with a capital of £7000, in £1 shares, to acquire the business carried on in Farringdon Street as the Pneumatic Gas Lighting Company, with certain patents relating to pneumatic apparatus for the distant lighting of gas-lamps and the like, and to carry on the said business, and that of gas and general engineers, &c. There is to be no initial public issue. The Southwell District Gas Company, Limited, has been registered with a capital of £20,000, in £1 shares, to acquire the business carried on by the Southwell Gaslight and Coke Company, Limited, and the Farnsfield and District Gas Company, Limited, to supply light, heat, and power in Southwell, Farnsfield, and neighbourhood. There will be no initial public issue.

SAWER.
S&P
PURVES.



MANCHESTER.
M&N
NOTTINGHAM.

Price of Gas at Gloucester.—In the report submitted to the recent half-yearly meeting of the Gloucester Gas Company, the Directors stated that, in view of the position of the Company's affairs, the Directors felt justified in again reducing the price of gas by 1d. per 1000 cubic feet, bringing the rate to ordinary consumers to 2s. 3d. To encourage the use of gas for motive power, they recommended a further reduction by 3d. per 1000 cubic feet for this purpose.

Gas Preferred to Electricity at Accrington.—The Accrington Corporation have considered the rival claims of incandescent gas and electricity; and the Committee recommend the adoption of the Welsbach-Kern system of gas lighting. The cost of conversion from ordinary to incandescent burners will be £580; and there will be an annual saving of over £235, besides an enormous improvement in the illumination of the streets. The saving will be approximately ¼d. in the rates.

Proposed Purchase of the Garw and Ogmore Water-Works.—The Ogmore and Garw Urban District Council have resolved—subject to the approval of the ratepayers, and to the confirmation of a statutory meeting of the Council—to promote a Bill for the purchase of the Garw Water-Works, the Ogmore Water-Works, and the Ogmore Electricity Works. The members are by no means unanimous on the question; for on the first occasion on which the project was mooted, there was a tie in the voting, which for some weeks left matters at a deadlock.

Free Public Lighting at Dewsbury.—While the minutes of the Gas, Electricity, and Water Committee were being considered last week, a member of the Dewsbury Town Council suggested that the time had come when they should adopt a different arrangement for the lighting of the streets. He contended that the gas and electricity for this purpose should be charged for, and then a reduction made in the price to the ordinary consumers. With this object in view, he proposed that a minute dealing with the estimates for the coming year be referred back. This, however, was defeated.

Chard Gas Supply.—At a meeting of the Chard Town Council on Thursday, the report of the Gas Committee was presented, showing that the increase of business had been maintained. The number of new consumers since the Corporation had taken over the gas-works was 144. Tenders had been received for a new retort-bench and alterations of the retort-house. Alderman Mitchell said the cost of the improvement was put at £3000. The Council would, however, not be asked to sanction the outlay of this sum until full particulars had been laid before them. The saving which would be effected by the improvements proposed would be about £350 per annum. The report was adopted, except as to the tenders.

The Suicide of a Gas Manager.—"Suicide while temporarily insane" was the verdict returned at the inquest on the body of Mr. Adam Cook, the Gas Manager at Killamarsh, whose tragic end was briefly recorded in the "JOURNAL" last week (p. 604). It transpired that deceased, who was 44 years of age, and had been at Killamarsh about seven years, was greatly worried with regard to some financial matters; Mr. Dyson Fitton, the Secretary of the Company, stating that he had appropriated two sums of money. There was, however, no intention on the part of the Company to take proceedings against him—in fact, deceased was gradually repaying the money, and had cleared off the first amount at the time of his death.

Quality of the Gas at Nottingham.—At the suggestion of the Nottingham Gas Committee, a conference is to take place between them and the local Chamber of Commerce on the subject of the gas supply. Meanwhile, an enlightening statement on the question has been made by Mr. Stiebel, a member of the latter body, who said that lately he noticed the gas in his warehouse was shockingly bad; and he telephoned to the Gas Offices. A foreman was sent on; and the Engineer (Mr. J. H. Brown) also came himself. Mr. Brown said there was nothing the matter with the gas; it was the fittings that were wrong They put new fittings there, and then into the office; and where before it was impossible to see, there was brilliant illumination afterwards.

Mr. Stelfox's Report on Gas Complaints.—There was practically no discussion on the presentation to the Belfast City Council of the minutes of the Gas Committee which contained Mr. Stelfox's report on gas complaints, which was noticed at length in last week's "JOURNAL." Mr. Boyd criticized Mr. Stelfox's remarks in support of carburetted water gas, and described it as most injurious from a hygienic point of view. It was therefore decided that Mr. Boyd should appear before the Gas Committee and discuss the merits of the question. Mr. Curley complained that in a great many cases the meters did not register accurately; while Mr. Johnston thought they had as good gas as was supplied anywhere, and at a cheap rate. The minutes were adopted.

Getting up a Testimonial.—A correspondent sends us a copy of the following circular signed by the Secretary of a Gas Company whose meeting was noticed recently in the columns of the "JOURNAL": "At the annual meeting of shareholders, held on ....., it was proposed and carried unanimously that the services of Mr. ..... as Chairman of the Company, should be recognized by the presentation to him of a piece of plate. It was pointed out that Mr. ..... has been connected with the Company for many years, and devoted untiring energy in its interest, and especially during the progress of the negotiations and passing of the Company's Act. The Company has prospered exceedingly of late years; and the Chairman can certainly lay claim to much of the credit of its success. I am instructed to send a circular-letter to all shareholders and old firms dealing with the Company, and ask them to subscribe to a fund for making a suitable presentation. If you wish me to add your name to the list of subscribers, will you kindly oblige by filling up the attached form, and returning it to me?" There may, of course, be grounds for suggesting that the shareholders should show their gratitude, in the manner suggested, to the Chairman of the Company for his efforts on their behalf; but it is difficult to find any justification whatever for applying to the "old firms dealing with the Company." On the other hand, there is a great deal to be said against an appeal of this character being addressed to those who have merely ordinary commercial relations with the Company.

How

RICHMOND'S

Have

GROWN.

1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905

The size of the figures denotes the progressive amount of business done year after year.

ADVERTISEMENT OF THE RICHMOND GAS STOVE & METER CO., LTD.
London Offices and Show-Rooms: 132, QUEEN VICTORIA STREET, E.C.
General Offices and Works: WARRINGTON, &c.

Burnley Water-Works Extensions.—The Burnley Corporation have decided to considerably extend their present water storage; and their Consulting Engineer, Mr. Diggle, has presented a report, in which he advises the making of a reservoir in the Thursden Valley, with an 88 feet embankment, to hold 400 million gallons of water. Until boring tests have been made, it is impossible to give an estimate of the cost. The report is being considered by the Water Committee.

Birmingham Water Supply.—The amount of water in store for the supply of Birmingham and the outlying districts has been largely increased by the heavy rain since the beginning of the year. The rain and snow fell very freely among the hills overlooking the Elan Valley, with the result that not only are the service reservoirs full, but the big Caban Coch reservoir is also nearly full. Twelve months ago the total amount of water in the storage reservoirs was 4651 million gallons; but at the present time it amounts to 10,097 millions, or within 1840 million gallons of the full capacity. The Frankley reservoir is nearly full; being only 8 million gallons short of its total capacity.

Unlawfully Connecting Water Supplies.—At the Crownhill Petty Sessions on Wednesday last, the Plymouth Corporation summoned John Bailey, the owner of two houses at Honicknowle, for affixing a pipe to a water service of the Corporation. It was stated that one of the houses was supplied with water by the Corporation; there being a service-pipe from the main to the house. The second house was let to a tenant, and defendant had fixed a pipe from his tap to the other house. In addition to the fact that only one house was paying water-rate, the Corporation objected to the connection because it was not made by a qualified plumber with standard pipes. A fine of 10s. and costs was imposed.

Large Sale of Water Annuities.—At a sale recently conducted by Mr. W. Cockerill, several lots of water annuities were disposed of to facilitate the closing of a trust. The first seven lots were perpetual annuities issued by the Bury and District Joint Water Board, on the security of the Board's water undertaking, and the following were the prices realized—the figures in parentheses being the amount of the annuity: £645 (£22 10s.), £630 (£21 12s.), £785 (£26), £1332 10s. (£44), £428 (£14), £2043 (£66 12s.), and £331 (£10 16s. 7d.). The two remaining lots were ten perpetual annuities of £10 each issued by the Heywood Local Board, and payable by the Heywood and Middleton Water Board, and four similar annuities. These lots sold for £289 and £117 respectively. So keen was the competition, that the sale from first to last only occupied about twenty minutes; and in that time £6600 changed hands.

The Cost of Public Lighting at Barnstaple.—A report on the progress of the municipal electric lighting undertaking was presented at a meeting of the Barnstaple Town Council yesterday week. The Mayor (Mr. H. Barrett), by whom it was made, claimed that the undertaking was now in a prosperous condition, and that on the year's working there was a profit of £269. His figures, however, showed that the cost of public lighting had been increased by £156; and Mr. Smale characterized the money spent on this item as abominable. As a matter of fact, the expenditure does show an enormous increase. In 1902, when Barnstaple was lighted by gas, the cost was £879, including repairs, wages of lamplighters, &c. In 1905, the cost for electric lighting in some streets was £1789, besides which £302 was paid for lighting the gas-lamps. In these circumstances, the ratepayers of Barnstaple are not profiting greatly by the possession of the electric light works, in spite of attempts to prove that they are an advantage to the borough.

APPLICATIONS FOR LETTERS PATENT.

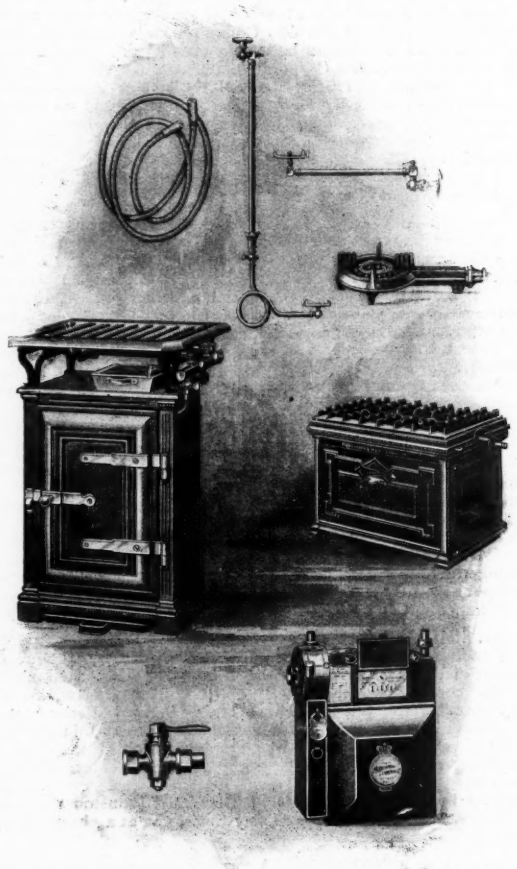
20,445A (1905).—Wesselsky, L., "Gas-generator." Feb. 21.
4015.—Grigg, H., and Breeden, F. V., "Bye-passes of gas-burners." Feb. 19.
4049.—Spreadbury, W. M., "Gas-taps." Feb. 19.
4077.—Müller, F., "Gas-producers." Feb. 19.
4080.—Schmalland, H., "Packing mantles." Feb. 19.
4119.—Ingrey, C., Bartlett, J., and Maclure, F., "Production of acetylene." Feb. 19.
4137.—Galliard, J., "Supports for gas-lamps." Feb. 20.
4156.—Armstrong, F. G. G., "Gas turbine." Feb. 20.
4158.—Miller, A. R., "Incandescent burners." Feb. 20.
4175.—Oakman, R. N., "Opening and closing gas-valves at a distance." Feb. 20.
4186.—Fletcher, L., "Safety gas-valve." Feb. 20.
4196.—Thompson, W. P., "Gas-engines." A communication from W. L. Morrow. Feb. 20.
4230.—Holmes, P. F. & E. D., and Cameron, E. G., "Extracting tar from illuminating gas." Feb. 20.
4239.—Helps, J. W., and Lemmon, N. G., "Inverted incandescent gas-burners." Feb. 21.
4320.—Forbes, Sir C. S., "Acetylene-generators." Feb. 21.
4358.—Miller-Pirrie, J., "Gas cooking-stoves." Feb. 22.
4367.—Eitle, C., "Charging retorts." Feb. 22.
4371.—Herbers, H., "Gas-burners." Feb. 22.
4377.—Bonniksen, B., and Berridge, T., "Gas lighting and extinguishing mechanism." Feb. 22.
4378.—Paterson, R. O., "Mouthpieces." Feb. 22.
4409.—Lance, D., and Elworthy, E. G., "Synthetic production of ammonia, cyanogen, and the nitrogen compounds generally, as well as of the simple or complex elements which enter into their manufacture." Feb. 22.
4427.—Coulson, S. G., "Solidifying tar." Feb. 23.
4433.—Hardy, H., "Indicating and regulating the temperature of gas-heated appliances. Feb. 23.
4451.—Schmitz, W., "Gas-burners." Feb. 23.
4472.—Shaw, E. J., "Gas-burners." Feb. 23.
4484.—Minter, A., "Mantles support." Feb. 23.
4526.—Warburton, W., "Inverted burners." Feb. 24.
4545.—North, W. C., "Gas-heater." Feb. 24.
4546.—Rose, A., and Bellamy, W., "Inverted burners." Feb. 24.

PARKINSON'S

COMPLETE

SLOT

INSTALLATIONS.



PARKINSON AND W. & B. COWAN, LTD.

(Parkinson Branch),

Cottage Lane, City Road, LONDON.

Bell Barn Road, BIRMINGHAM.

The annual dinner of the employees of the Wandsworth and Putney Gas Company was held last Saturday week, under the presidency of the Engineer, Mr. H. O. Carr, who was supported by the Secretary, Mr. C. W. Braine, and other gentlemen. In proposing the toast of "Prosperity to the Company," the Chairman made allusion to the loss they had sustained by the death of their late Chairman, Dr. Howell; and he then dealt in a humorous manner with various topics in which his hearers were interested. The toast was responded to by Mr. Braine, who remarked that the prosperity of the Company was built up by the willing co-operation of everybody. The attendance was a record one; and the function was in every respect thoroughly satisfactory, an excellent musical programme being gone through.

The report of the Directors of the Richmond Gas Stove and Meter Company, Limited, for the year ending Dec. 31, to be presented at the general meeting next Thursday, sets forth that the balance standing to the credit of the profit and loss account, after deducting debenture interest and including the amount brought forward from last year, is £33,537. The payment of the 6 per cent. dividend on the preference shares will absorb £5737; one at the rate of 10 per cent. (free of income-tax) on the ordinary shares, £8036; and a bonus (also free of income-tax) at the rate of 2½ per cent., £2009. A sum of £5313 is to be written off for depreciation, and £6842 is to be placed to the credit of the general reserve fund—making this fund £35,000, and carrying forward £5600.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

GAS-WORKS FOREMAN. No. 4568. Applications by March 10.
CANVASSERS. No. 4567.
LEAKAGE DETECTOR, &c. No. 4570.

Situations Wanted.

SALESMAN, BOOKKEEPER, COLLECTOR, &c. D., 18, Ferndale Avenue, Walthamstow.
INSPECTOR DISTRIBUTION DEPARTMENT. No. 4569.
IN GAS METER FACTORY. Meter, Hemingford Road, N.

Agency Wanted. Progress, c/o Willing's.

Plant (Second-Hand), &c., for Sale.

CHEMICAL MANUFACTURING PLANT. R. M'Tear and Co., Glasgow.
GASHOLDERS AND TANKS. Cowdenbeath Gas Company.
RETORT-HOUSE FITTINGS, ROOF, SULPHATE PLANT, &c. Hastings and St. Leonards Gas Company.
RETORTS, MOUTHPIECES, ASCENSION, &c., PIPES, HYDRAULIC MAINS, FURNACE IRON WORK, AND SEAL VALVES (UNUSED). Yeadon and Guiseley Gas Company.
STATION METER. Redditch Gas Company.
STREET LANTERNS. Malton Gas Company.
WALKER'S PURIFYING MACHINE. Cannock, Hednesford, and District Gas Company.

TENDERS FOR

Coal and Cannel.

ALTRINCHAM GAS COMPANY. Tenders by March 12.
MIDDLETON GAS DEPARTMENT. Tenders by March 14.
STOCKPORT GAS DEPARTMENT. Tenders by March 14.

Cookers.

PONTYPRIDD GAS DEPARTMENT. Tenders by March 12.

Exhauster and Gas-Engine.

RHONDDA GAS DEPARTMENT. Tenders by March 14.

Fire-Clay Goods.

HUDDERSFIELD GAS DEPARTMENT. Tenders by March 13.
MILLOM GAS DEPARTMENT. Tenders by March 31.
RHONDDA GAS DEPARTMENT. Tenders by March 14.
STOCKPORT GAS DEPARTMENT. Tenders by March 14.

Fittings, Gas, Water, and Gun Metal, and Compo Pipe, &c.

RHONDDA GAS AND WATER DEPARTMENT. Tenders by March 14.
STOCKPORT GAS DEPARTMENT. Tenders by March 14.

Gasholder.

AIRDRIE GAS DEPARTMENT. Tenders by March 21.

General Stores, Shovels, Oil, Paints, Iron and Steel, Ironmongery, &c., &c.

HUDDERSFIELD GAS DEPARTMENT. Tenders by March 13.
RHONDDA GAS AND WATER DEPARTMENT. Tenders by March 14.
STOCKPORT GAS DEPARTMENT. Tenders by March 14.

Governor and Connections.

RHONDDA GAS DEPARTMENT. Tenders by March 14.

Governor and Exhauster House.

RHONDDA GAS DEPARTMENT. Tenders by March 14.

Lime.

HUDDERSFIELD GAS DEPARTMENT. Tenders by March 13.
RHONDDA GAS DEPARTMENT. Tenders by March 14.
STOCKPORT GAS DEPARTMENT. Tenders by March 14.

Meters.

RHONDDA GAS DEPARTMENT. Tenders by March 14.
STOCKPORT GAS DEPARTMENT. Tenders by March 14.

Oil for Gas Making.

PONTYPRIDD GAS DEPARTMENT. Tenders by March 12.

Oxide (New and Spent).

BROADSTAIRS GAS COMPANY. Tenders by March 12.
HUDDERSFIELD GAS DEPARTMENT. Tenders by March 13.
KINGS LYNN GAS COMPANY. Tenders by March 20.

Pipes, &c.

HUDDERSFIELD GAS DEPARTMENT. Tenders by March 13.
RHONDDA GAS AND WATER DEPARTMENT. Tenders by March 14.
STOCKPORT GAS DEPARTMENT. Tenders by March 14.
YORKTOWN AND BLACKWATER GAS COMPANY. Tenders by March 15.

Purifier Grids.

HUDDERSFIELD GAS DEPARTMENT. Tenders by March 13.

Retort Ironwork.

MILLOM GAS DEPARTMENT. Tenders by March 31.

Sulphuric Acid.

HUDDERSFIELD GAS DEPARTMENT. Tenders by March 13.
PONTYPRIDD GAS DEPARTMENT. Tenders by March 12.
RAMSGATE GAS DEPARTMENT. Tenders by March 10.
RHONDDA GAS DEPARTMENT. Tenders by March 14

Tar and Liquor.

EXETER GASLIGHT COMPANY. Tenders by March 10.
RAMSGATE GAS DEPARTMENT. Tenders by March 10.
SLOUGH GAS AND COKE COMPANY. Tenders by March 13.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 635.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p.c.	21½–22½	+½	4 13 4
160,000	10	,,	7½	Do. 7 p.c.	14½–15½	..	4 16 9
200,000	5	Nov. 15	7	Bombay, Ltd.	6¾–7¼	..	4 16 7
40,000	5	,,	7	Do. New, £4 paid	4¾–5¼	..	5 6 8
50,000	10	Aug. 31	14	Bourne- mouth Gas & Water 10 p.c.	29–30	..	4 13 4
51,810	10	,,	7	Do. B 7 p.c.	17–18	..	3 17 9
53,200	10	,,	6	Do. Pref. 6 p.c.	15½–16½	..	3 12 9
380,000	Stk.	Feb. 22	12½	Brentford Consolidated	260–265	..	4 14 4
300,000	,,	,,	9⅜	Do. New	192–197*	..	4 16 5
50,000	,,	,,	5	Do. 5 p.c. Pref.	123–128	..	3 16 11
206,250	,,	Dec. 14	4	Do. 4 p.c. Deb.	103–106	+2	3 15 6
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig.	230–235	..	4 15 9
246,320	,,	,,	8½	Do. A. Ord. Stk.	167–172	..	4 15 11
460,000	20	Sept. 28	10	British	43–44	..	4 10 11
100,000	Stk.	Feb. 22	6	Bromley, Ord. 5 p.c.	119–122*	+1	4 18 4
165,700	,,	,,	4½	Do. do. 3½ p.c.	90–93*	+1	4 16 9
500,000	10	Oct. 13	7	Buenos Ayres (New) Ltd.	12½–13	..	5 7 8
250,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb.	97–99	+1	4 0 10
150,000	20	July 13	8½	Cagliari, Ltd.	24–20	..	6 6 11
100,000	10	Sept. 28	10	Cape Town & Dis., Ltd.	17–17½	..	5 14 3
100,000	10	Oct. 27	4½	Do. 4½ p.c Pref.	10–10½	..	4 5 9
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	53–55	..	5 9 1
50,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	100–102	..	4 8 3
1,443,280	Stk.	Feb. 22	5⅛	Commercial 4 p.c Stk.	114–116*	..	4 9 7
560,000	,,	,,	5	Do. 3½ p.c. do.	111–113*	..	4 8 6
475,000	,,	Dec. 14	3	Do. 3 p.c. Deb. Stk.	84–86	..	3 9 9
800,000	Stk.	,,	6½	Continental Union, Ltd.	130–133	−1	4 17 9
200,000	,,	,,	7	Do. 7 p c Pref.	143–148	..	4 14 7
424,070	Stk.	—	5½	Derby Con. Stk.	—	..	—
55,000	,,	—	4	Do. Deb. Stk.	—	..	—
486,090	10	Jan. 25	11	European, Ltd.	22–23	−½	4 15 8
354,060	10	,,	11	Do. £7 10s. paid	16–17	..	4 17 0
15,223,235	Stk.	Feb. 8	4⅛	Gas- light & Coke 4 p.c. Ord.	93½–94½	−½	4 8 5
2,600,000	,,	,,	3½	Do. 3½ p.c. max.	87–89	..	3 18 8
3,799,735	,,	,,	4	Do. 4 p.c. Con. Pref.	106–108	−1	3 14 1
4,193,975	,,	Dec. 14	3	Do. 3 p.c. Con. Deb.	88–90	..	3 6 8
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	101–103	..	4 17 1
82,500	,,	,,	6½	Do. do. 5 p.c.	123–126	..	5 3 2
70,000	10	Oct. 13	11	Hongkong & China, Ltd.	20–21	..	5 4 9
3,800,000	Stk.	Nov. 15	10	Imperial Continental	234–236	+1	4 4 9
473,600	Stk.	Feb. 8	3½	Do. 3½ p.c. Deb. Red.	95–97	..	3 12 2
175,242	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c.	123–128	..	4 13 9
561,000	Stk.	Feb. 22	10	Liverpool United A	234–236*	..	4 4 9
718,100	Stk.	Feb. 22	7	Liverpool United B	165½–166½*	..	4 4 1
306,083	,,	Dec. 29	4	L'rpool Unit'd Deb. Stk.	109–111	..	3 12 1
75,000	5	Dec. 14	5	Malta & Medn., Ltd.	4¼–4¾	..	5 5 3
560,000	100	Oct. 2	5	Met. of 5 p.c. Deb.	103–105	..	4 15 3
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	103–105	..	4 5 9
541,920	20	Nov. 15	3½	Monte Video, Ltd.	11½–12½	..	5 12 0
1,675,892	Stk.	Feb. 22	4½	Newc'tle & G'tesh'd Con.	106–108*	+½	4 5 8
406,025	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.	98–100	..	3 10 0
15,000	10	Aug. 31	10	North Middlesex 10 p.c.	19–20	..	5 0 0
52,940	1	,,	7	Do. 7 p.c.	13–14	..	5 0 0
300,000	Stk.	Nov. 30	8	Oriental, Ltd.	148–151	..	5 6 0
600,000	5	Sept. 14	7	Ottoman, Ltd.	6–6½	..	5 7 8
398,490	5	Apl. 28	6	Primitiva Ord.	7–7½	..	4 0 0
796,980	5	Jan. 25	5	Do. 5 p.c. Pref.	5½–5⅝	..	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	98–100	..	4 0 0
851,070	10	Oct. 13	7	River Plate Ord.	12⅞–13¼	..	5 5 8
300,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb.	97–99	..	4 0 10
250,000	10	Sept. 28	7	San Paulo, Ltd.	13¾–14	..	5 0 0
70,000	50	Jan. 2	5	Do. 5 p.c. Deb.	50–52	..	4 16 2
135,000	Stk.	Sept. 14	10	Sheffield A	244–246	..	4 1 4
209,984	,,	,,	10	Do. B	244–246	..	4 1 4
523,498	,,	,,	10	Do. C	244–246	..	4 1 4
126,106	Stk.	Aug. 31	5⅜	Shrewsbury Ord. 5 p.c.	110–120	..	4 11 8
70,000	10	Sept. 28	10	South African	16–17	..	5 17 8
6,250,000	Stk.	Feb. 22	5⅜	South Met., 4 p.c. Ord.	128–130*	..	4 4 7
1,895,445	,,	Jan. 11	3	Do. 3 p.c. Deb.	87–89	..	3 7 5
575,000	Stk.	Aug. 16	5⅜	S'th Suburb'n Ord. 5 p.c.	123–126	..	4 7 4
60,000	,,	,,	5	Do. 5 p.c. Pref.	127–132	..	3 15 9
112,533	,,	Jan. 11	5	Do. 5 p.c. Deb. Stk.	132–137	..	3 13 0
502,310	Stk.	Nov. 15	5	Southampton Ord.	109–112	..	4 9 3
363,020	,,	,,	6¼	Tottenham A 5 p.c.	127–130	+2	4 16 2
120,000	Stk.	Aug. 31	4⅛	and B 3½ p.c.	101–104	+2	4 11 4
137,500	,,	Dec. 14	4	Edmonton 4 p.c. Deb.	105–107	..	3 14 9
182,380	10	Dec. 29	8	Tuscan, Ltd.	10–10½	..	8 0 0
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	99–101	..	4 19 0
30,000	Stk.	Feb. 22	7½	Wands- worth A 5 p.c.	—	..	—
255,636	,,	,,	6¼	B 3½ p.c.	133–136*	..	4 11 11
75,000	,,	,,	5⅛	and C 3½ p.c.	110–113*	..	4 16 0
69,416	,,	Dec. 29	3	Putney 3 p.c. Deb. Stk.	82–85	..	3 10 7
745,872	,,	Aug. 16	5⅜†	West Ham 5 p.c. Ord.	106–108	..	4 14 11
185,000	,,	,,	5	Do. 5 p.c. Pref.	123–126	..	3 19 4
193,300	,,	Dec. 29	4	Do. 4 p.c. Deb. Stk.	102–107	..	3 14 9

Prices marked * are "Ex. div."

† Next dividend will be at this rate.

OXIDE OF IRON.

O'NEILL'S OXIDE
For GAS PURIFICATION.

LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LD.
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism London."

GAZINE—A radical Solvent and Preventative of Naphthalene deposits, which has been used for many years on the Continent for the cleaning of Mains and Services, and is now being adopted in England. It is also used for the Enrichment of Gas, and has an Illuminating Value of double that of 90 per cent. Benzol.
Supplied by C. BOURNE, 120, Manor House Road, NEWCASTLE-ON-TYNE.

BROTHERTON & CO., LIMITED.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

GLASS SHADES of every description,
for all kinds of Interior GAS LIGHTING.
Illustrated sheets on application.
JOHN WALSH WALSH,
SOHO AND VESTA GLASS WORKS, BIRMINGHAM.
Telegrams: "VESTA, BIRMINGHAM."
National Telephone: No. 63.
London Show-Room: 4, HOLBORN CIRCUS, E.C.

GAS TAR wanted.
BROTHERTON AND Co., LTD., Tar Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, AND WAKEFIELD.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

SULPHURIC ACID for Sale, specially
suitable for making Sulphate of Ammonia.
BROTHERTON AND Co., LTD., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

"VITERNUS" METALLIC PAINT FOR GAS-WORKS PLANT.
JOHN E. WILLIAMS AND CO.,
LOWER MOSS LANE,
MANCHESTER, S.W.
Telegrams: "ENAMEL." National Telephone 1759.

AMMONIACAL Liquor wanted.
BROTHERTON AND Co., LTD., Ammonia Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, AND WAKEFIELD.

GAS OILS.
MEADE-KING, ROBINSON, & CO.
Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 8, EXCHANGE STREET, MANCHESTER, and 11, OLD HALL STREET, LIVERPOOL.

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
JOSEPH TAYLOR AND Co., CENTRAL PLUMBING WORKS, BOLTON.
Telegrams: SATURATORS, BOLTON. Telephone 0848.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

TO WATER AND GAS COMPANIES REQUIRING CAPITAL.
THE Water and Gas Debenture Share
Investment Trust, Limited, of 37, High Street, Tunbridge Wells, are prepared to Invest £10,000 Capital in above, and also to Underwrite Progressive Water and Gas Companies' issues.

PATENTS AND TRADE MARKS
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

J. & J. BRADDOCK (Branch of Meters
Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 254 Oldham, and 2412 HOP, London.
Telegrams:—
"BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

DUTCH OXIDE OF IRON.

SPENT OXIDE PURCHASED IN ANY DISTRICT.

THE First Dutch Bogore Co., Ltd.,
HOLLAND.
General Manager (for England and Wales)—
CHARLES E. FRY, LEAMINGTON.
General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

TAR AND LIQUOR WANTED.
Best Prices paid.
DENT AND Co.,
Ouse Chemical Works, SELBY.

TEMPERLEY TRANSPORTERS
FOR Rapid and Economical Handling
of Coal and Coke in Gas-Works.
Illustrated Advertisement will appear on March 27.
TEMPERLEY TRANSPORTER COMPANY,
72, BISHOPSGATE STREET WITHIN, LONDON, E.C.
Telephone: 365 LONDON WALL. Telegrams: "TRANSUMO."

APPLICANTS for the Position of InSPECTOR OF MAINS AND SERVICES, Advertised under No. 4535, are THANKED and Informed that the APPOINTMENT HAS BEEN MADE.

CANVASSERS.—Several smart Men
required, on Salary and Commission, to call on Householders to solicit orders for Gas-Stoves.
Address No. 4567, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a young Man (age 26),
RE-ENGAGEMENT in Gas-Meter Factory. Town or Country. Understands Accounts, Correspondence, &c., Office and Factory routine. Six Years last place. Excellent References.
Address, METER, 129, Hemingford Road, LONDON, N.

WANTED, Situation as Salesman,
Book-Keeper, Collector, or any Position of Trust. Age 31. Highest References (over 8 years). Strictly Temperate. Accustomed to Engineer's Office, &c. Moderate Salary for permanent position, with prospects.
Apply, D., 18, Ferndale Avenue, WALTHAMSTOW.

ADVERTISER seeks Situation as InSPECTOR of Distribution Department. Practical and thoroughly Experienced in all Branches, Control of Workmen, Automatic Installations, Public and Private Lighting, Mains and Services, and Advising Consumers. Married. References.
Address No. 4569, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a capable Man to detect and
remedy Leakage in Colliery district. Preference given to one having filled similar position. Would be required to fill in spare time Meter Taking, Service Laying, &c., to instructions of Foreman.
State Age and Wages required, enclosing *copies* of Two recent Testimonials, to No. 4570, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS-WORKS FOREMAN.
WANTED, for a Gas-Works in the South
of England (annual make about 100 Millions), a Retort-House and Yard FOREMAN. Must thoroughly understand Control of Men and all Gas Plant, especially Regenerator Settings.
House, Coal, and Gas provided.
Applications, stating Age, Experience, and Wages required, together with *copies* of Three recent Testimonials, to be addressed to No. 4568, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C., not later than Saturday, the 10th inst.

WANTED, Gas Meters, Obsolete, Wets
or Drys, for Cash.
ROSSE WORKS, Leeds Road, BRADFORD.

STREET Lanterns for Sale, 14-inch
and Bray's. Second-Hand.
Apply MALTON GAS COMPANY.

CANNOCK, HEDNESFORD, AND DISTRICT GAS COMPANY, LIMITED.
OFFERS invited for One C. & W.
Walker's PURIFYING-MACHINE, with TAR-EXTRACTOR, 10-inch Valves and Connections complete, to pass 200,000 cubic feet of Gas per Twenty-Four hours. The above Machine may be seen working, and is being replaced by a larger one.
By order of the Directors,
T. A. NICHOLLS,
Secretary.
Gas-Works, Cannock.

OXIDE OF IRON.
(NATURAL.)
BALE & CHURCH will be pleased to
send Quotations and Samples on application.
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT for all Retort and Furnace work.
PAINT for Gasholders, Purifiers, &c.
5, CROOKED LANE, LONDON, E.C.

SULPHURIC ACID.

SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER, CHAPMAN, & MESSEL, LTD.
(with which is amalgamated WM. PEARCE & SONS, LTD.),
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone 341, AVENUE.

REDDITCH GAS COMPANY.
STATION Meter for Sale. Handsome
design. Perfect Condition. Capacity, 11,200 feet per hour. Cheap to immediate purchaser.
ALBERT E. LAYTON,
Manager.

GAS PLANT for Sale—I can always offer
NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

GAS PLANT FOR SALE.
THE Hastings and St. Leonards Gas
Company, having transferred the Manufacture of Coal Gas to their new Glyne Gap Works, have for DISPOSAL a quantity of GAS-WORKS PLANT in good working order. The Plant consists principally of Retort-House Fittings, Roofs, &c.; also a complete SULPHATE PLANT.
Inquiries are solicited by Mr. C. E. Botley, Engineer and General Manager, Gas Company's Offices, Hastings, who will be glad to furnish specific details.
March 2, 1906.

FOR SALE—Two Small Gasholders,
one 20 feet diameter by 12 feet deep, with 4 Cast-Iron Columns, Lattice Frame Work, Pulleys, Chains, and Weights complete. The other is 12 feet diameter by 12 feet deep, with 3 Channel Columns, and T-Iron Frame Work, Pulleys, Chains, and Weights complete; also Steel Tank for above holder.
Offers to be sent to J. B. SCOTT, Manager, Cowdenheath Gas Company, Limited, from whom further Particulars may be had.
The Purchaser must bear the expense of Taking Down and Removing.

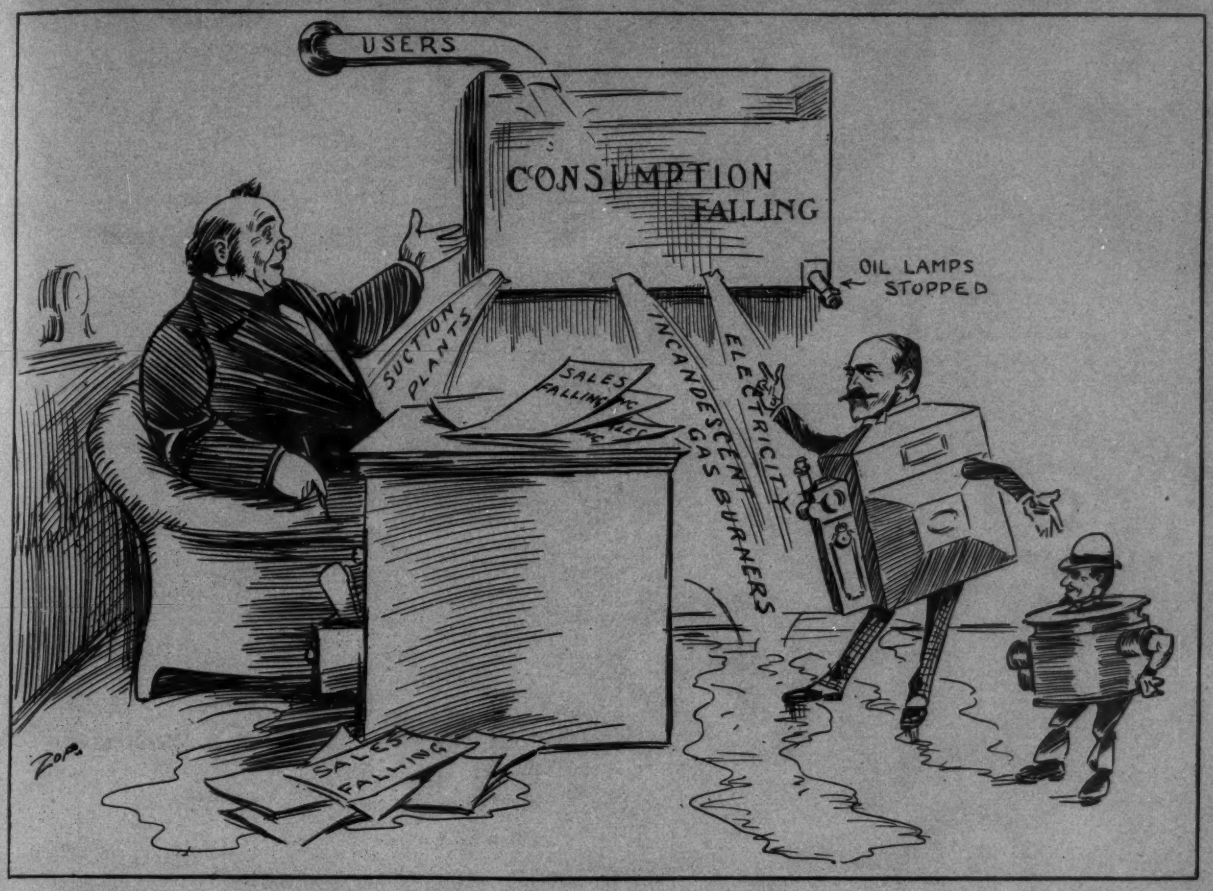
FOR SALE, cheap, the undermentioned—
Four PURIFIERS, 10 ft. by 10 ft. by 4 ft. 6 in. deep, complete.
Two ditto, 10 ft. by 10 ft. by 4 ft. 6 in. deep, complete.
Two ditto, 10 ft. by 5 ft. by 4 ft. deep, complete.
One Cast-Iron SCRUBBER, 12 ft. high by 6 ft. dia.
One ditto 4-inch VERTICAL CONDENSER.
A quantity of good GAS-VALVES, all sizes, from 4-inch to 24-inch diameter.
Inquiries Invited for any other Gas Plant.
Apply to SAML. WHILE & SON, 60, Queen Victoria Street, LONDON, E.C.

TO GAS COMPANIES AND CONTRACTORS.
THE Yeadon and Guiseley Gas Company
have for Sale—
Twenty 19 in. by 14 in. by 8 ft. 6 in. overall Ω-RETORTS, with Mouthpieces and Lids.
Twenty Sets of 5-inch ASCENSION, ARCH, and DIP PIPES.
Four STEEL HYDRAULIC MAINS, each to accommodate 5 Dip Pipes.
Four Sets of DIRECT FURNACE IRONWORK.
Four SEAL VALVES.
The whole of the Ironwork has never been in use, and was new when erected Seven years ago, when it was decided to adopt Regenerator Settings.
Applications and permission to view to be made to Mr. EDWARD LISTER, Manager.

TENDERS FOR GAS-MAINS.
THE Yorktown and Blackwater Gas
Company invite TENDERS for the following Cast-Iron GAS-MAINS—

1100	Yards of	10-inch.
2400	"	8 "
1000	"	6 "
2200	"	4 "
3400	"	3 "

The 10-inch and 8-inch Pipes to be delivered to Blackwater Station (South Eastern Railway), and the 6-inch, 4-inch, and 3-inch to Wellington College Station (South Eastern Railway).
The Contractor is to specify the length and weight per pipe in each size.
All Pipes to be new, grooved in socket, and coated with Dr. Angus' solution.
Tenders, stating time required for delivery, which must be in rotation as stated above, to be addressed to the undersigned before the 15th of March, from whom any further Particulars may be obtained.
J. MEIKLEJOHN,
Engineer and Manager.
Feb. 26, 1906.

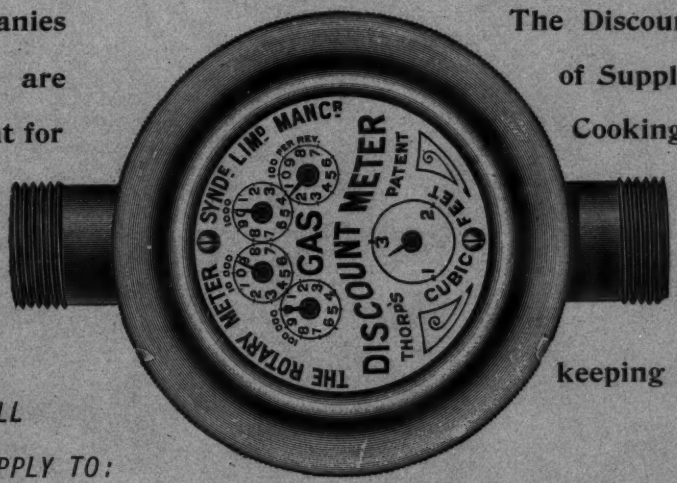


Gas Director: Alas! Alas! Our consumption falls.

Marsh (Pioneer of Slot-Meter System): Cheer up! I bring you the Discount-Meter Man. He will halve your losses and double your gains.

Electricity Companies and Corporations are now selling Current for Heating and Cooking at Reduced Rates.

FOR PRICES AND FULL PARTICULARS APPLY TO:



The Discount Meter System of Supply for Heating and Cooking is the only certain method of increasing your Gas Sales and keeping your Competitors at bay.

T. G. MARSH,
28, Deansgate, MANCHESTER.

Printed and Published by Walter King, at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, March 6, 1906.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, ROSE MOUNT IRON-WORKS, ELLAND.

TENDERS FOR TAR.

THE Directors of the Exeter Gaslight and Coke Company invite TENDERS for their surplus TAR for Twelve Months, from the 25th of March next, at per ton of 200 Gallons, delivered into Contractor's tanks at the Company's works.

Sealed Tenders, endorsed "Tender for Tar," will be received by the undersigned on or before Saturday, the 10th of March next; but the Directors do not bind themselves to accept the highest or any Tender.

By order,
W. A. PADFIELD,
Engineer and Secretary.

Feb. 20, 1906.

RAMSGATE CORPORATION.
(GAS DEPARTMENT.)

TENDERS FOR TAR.

THE Gas and Water Committee invite TENDERS for the purchase of the Surplus TAR (150,000 Gallons or thereabouts) to be made between the 1st of April, 1906, and the 31st of March, 1907.

Tenders to be sent in on or before Saturday, the 10th day of March, 1906, addressed to the Chairman of the Gas and Water Committee, Gas-Works, Boundary Road, Ramsgate, and endorsed "Tender for Tar."

The Committee do not bind themselves to accept the highest or any Tender.

Further Particulars on application to
T. N. RITSON,
Engineer and Manager.

Gas and Water Offices,
Boundary Road, Ramsgate.

RAMSGATE CORPORATION.
(GAS DEPARTMENT.)

TENDERS FOR SULPHURIC ACID.

THE Gas and Water Committee invite TENDERS for the supply of about 225 Tons of best BRIMSTONE ACID (what is known as 80 per cent. Acid, with a specific gravity of 142° Twaddel), to be delivered in equal monthly quantities between the 1st of April, 1906, and the 31st of March, 1907.

Tenders to be sent in on or before Saturday, the 10th day of March, 1906, addressed to the Chairman of the Gas and Water Committee, Gas-Works, Boundary Road, Ramsgate, and endorsed "Tender for Sulphuric Acid."

The Committee do not bind themselves to accept the lowest or any Tender.

Further Particulars on application to
T. N. RITSON,
Engineer and Manager.

Gas and Water Offices,
Boundary Road, Ramsgate.

RHONDDA URBAN DISTRICT COUNCIL.
(GAS AND WATER DEPARTMENT.)

THIS Council are prepared to receive TENDERS for the supply of LIME, ACID, FIRE-BRICKS, GAS, WATER, and GUN-METAL FITTINGS, GAS METERS, OILS and PAINTS, IRONMONGERY, BOOKS, and STATIONERY, as may be required for the Year ending the 31st of March, 1907.

Also for Wrought-Iron TUBES, and LEAD and COMPO. PIPES for the Half-Year ending Sept. 30, 1906.

Forms of Tender may be obtained—except those for Gas, Water, Gun Metal Fittings, Ironmongery, Books, and Stationery, which will only be supplied to those inspecting samples—on application to Mr. Octavius Thomas, Engineer and Manager, Gas and Water Offices, Pentre, Glam.

No Form of Tender other than that issued by the Council will be considered.

The Contractor will be required to pay the standard rate of wages recognized in the district.

Tenders, endorsed "Contract No. 1, 2, &c.," as the case may be, to be addressed to the Chairman of the Gas and Water Committee, and sent to the undersigned on or before Ten a.m. on Wednesday, the 14th of March.

The Council do not bind themselves to accept the lowest or any Tender.

WALTER P. NICHOLAS,
Clerk to the Council.

Council Offices, Pentre,
Glam., Feb. 26, 1906.

RHONDDA URBAN DISTRICT COUNCIL.
(GAS AND WATER DEPARTMENT.)

THIS Council are prepared to receive TENDERS for the following:

CONTRACT No. 33—The Erection of a GOVERNOR and EXHAUSTER HOUSE at Treorchy.

CONTRACT No. 34—Fifteen-inch GAS STATION GOVERNOR and CONNECTIONS.

CONTRACT No. 35—GAS ENGINE and EXHAUSTER to pass 30,000 cubic feet per hour.

Plans and Specifications may be seen, and Forms of Tender supplied, upon application to Mr. Octavius Thomas, the Engineer and Manager, Gas and Water Offices, Pentre, Glam., upon depositing the sum of One Guinea, which will be returned on receipt of a *bond-fide* Tender, but to be forfeited in the case of withdrawal of Tender after acceptance by the Council.

The Contractor will be required to pay the standard rate of wages recognized in the district.

Tenders to be addressed to the Chairman of the Gas and Water Committee, endorsed "Contract No. 33, &c.," and delivered at my Office not later than Ten a.m., on Wednesday, the 14th inst.

The Council do not bind themselves to accept the lowest or any Tender.

WALTER P. NICHOLAS,
Clerk.

Council Offices, Pentre,
Glam., March 1, 1906.

THE Directors of the Broadstairs Gas Company invite TENDERS for the purchase of about 70 Tons of SPENT OXIDE; also for the supply of about 40 Tons of NEW OXIDE.

Tenders to be sent in not later than March 12, addressed to the Chairman of the Company, Gas Office, Broadstairs.

The Directors do not bind themselves to accept the lowest or any Tender.

Further Particulars may be obtained from the undersigned.

F. HIGGINSON,
Engineer and Secretary.

Gas Office, Broadstairs,
March 1, 1906.

SLOUGH GAS AND COKE COMPANY.

THE Directors of this Company invite TENDERS for the Surplus TAR and AMMONIACAL LIQUOR for One Year.

The estimated quantities produced are: Tar, 45,000 Gallons; and Ammoniacal Liquor, 60,000 Gallons per Annum.

The Company have a Railway Siding connecting their Works with the Great Western Railway; and the Grand Junction Canal has a Wharf close to the Works.

Prices to be stated for Tar and Liquor at the Company's Works.

The Directors do not bind themselves to accept the highest or any Tender.

Tenders to be delivered to me on or before Tuesday, the 13th inst.

ARTHUR THOMAS,
Secretary.

High Street, Slough,
March 1, 1906.

PONTYPRIDD URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

PURCHASE OF SULPHURIC ACID AND GAS-COOKERS.

THE above Council invite Tenders for—

(1) The Supply of 100 Tons of SULPHURIC ACID for Sulphate Manufacture, in quantities as required.

(2) The Purchase of Slot and Hiring COOKERS.

Specification and Form of Tender may be obtained from Mr. Edward Jones, Engineer, Gas-Works, Treforest.

Tenders, on the prescribed Form, sealed, and endorsed "Acid, No. 3 Contract," or "Cookers, No. 1 Contract," as the case may be, must be received by the undersigned not later than noon on Monday, the 12th of March, 1906.

J. COLENSO JONES,
Clerk to the Council.

District Council Offices,
Pontypridd, Feb. 21, 1906.

PONTYPRIDD URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

OIL FOR CARBURETTED WATER-GAS PLANT.

THE above Council invite Tenders for the supply of about 300 Tons of OIL for the Manufacture of Carburetted Water Gas.

The Oil is to have a flashing point of not less than 73°, Abel's test.

Sealed Samples and Analyses of Oils offered must be sent to Mr. Edward Jones, Engineer, Gas-Works, Treforest, from whom any further Information may be obtained.

The prices must be quoted per Imperial gallon, and must include delivery in seller's tank at the Gas-Works Siding, Glyntaff, on the Alexandra Docks and Railway Company's line.

Tenders, sealed, and endorsed "Gas Oil," must be received by me not later than noon on Monday, the 12th of March, 1906.

J. COLENSO JONES,
Clerk to the Council.

District Council Offices,
Pontypridd, Feb. 21, 1906.

COUNTY BOROUGH OF STOCKPORT.
(GAS DEPARTMENT.)

TENDERS FOR STORES, CANNEL, AND COAL.

THE Gas Committee are prepared to receive TENDERS for the supply of the following MATERIAL and CANNEL and COAL. General Stores for One Year, from April 1, 1906, to March 31, 1907. Cannel and Coal for One, Two, or Three Years.

1—Bolts and Nuts.
2—Brushes.
3—Brass and Meter Fittings.
4—Cartage (for Three years).
5—Castings.
6—Drysaltery.
7—Retort and Fire Goods.
8—Glass, Red & White Lead.
9—Iron and Steel.
10—Ironmongery.
11—Lead Pipe.
12—Mill Furnishing.
13—Oils and Tallow.
15—Ropes and Flax.
16—Shovels & Pick Heads.
17—Timber, English and Foreign.
18—Tubing.
19—Wet and Dry Meters.
20—Stationery.
21—Lime.
22—Cannel and Coal, for 1, 2, or 3 years.
23—Oil.

Forms of Tender and all further Information may be obtained on application to the Engineer, Gas-Works, Portwood.

No Form of Tender other than that issued by the Committee will be accepted.

Sealed Tenders, endorsed "1," "2," "3," &c., as the case may be, must be addressed to the Chairman of the Gas Committee, and be delivered at the Town Clerk's Office, on or before the 14th of March next ensuing.

No Tender will be accepted without satisfactory proof that the Firm Tendering pays the Trade Union rate of wages and observes the Trade Union number of hours as are usually paid and observed in the district where the goods are made or produced.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
ROBERT HYDE,
Town Clerk.

Stockport, March 2, 1906.

SPENT OXIDE.

THE Kings Lynn Gas Company invite TENDERS for the Purchase of about 200 Tons of SPENT OXIDE.

Particulars and Samples may be obtained of the undersigned, to whom Quotations should be addressed, not later than the 20th inst.

EDMUND G. SMITHARD,
Engineer and Manager.

Gas-Works, King's Lynn,
March 3, 1906.

MILLOM URBAN DISTRICT COUNCIL
(GAS DEPARTMENT)

INVITE Tenders for Fire-Clay Materials and IRONWORK for Retorts.

Forms of Tender and full Particulars can be obtained on application to Mr. Jackson, Gas Manager, Millom.

Sealed Tenders, endorsed "Retorts Material," must be sent to me before the 31st of March inst.

The Council do not undertake to accept the lowest or any Tender.

W. T. LAWRENCE,
Clerk to the Council.

Millom, March 3, 1906.

THE Airdrie Town Council are pre- pared to receive TENDERS for the Construction of a Two-Lift GASHOLDER, 115 ft. 9 in. diameter by 30 ft. deep.

Drawings may be seen, and copies of the Specification may be obtained, at the Office of the Engineers, Messrs. A. Gillespie and Son, 65, Bath Street, Glasgow, on and after Friday, March 9, 1906.

Copies of the Drawings will be supplied to parties Tendering at a charge of 12s. 6d. per set.

Sealed Tenders to be delivered to the subscriber not later than Wednesday, the 21st of March, 1906, endorsed "Tender for Gasholder."

G. B. MOTHERWELL,
Town Clerk.

Town Clerk's Chambers,
10, Bank Street, Airdrie,
March 1, 1906.

THE Corporation of Middleton are pre- pared to receive TENDERS for the COAL and CANNEL required at their Gas-Works.

Further Particulars and Form of Tender from Mr. E. E. J. Anderson, M.I.M.E., Gas Engineer.

Tenders, addressed to the Chairman of the Gas Committee, endorsed "Tender for Coal" or "Cannel," as the case may be, are to be delivered at my Office on or before Wednesday, the 14th of March, 1906.

The Corporation do not bind themselves to accept the lowest or any Tender.

Persons or Firms Tendering are required to conform to a fair wages clause which is contained in each Form of Tender.

FREDERICK ENTWISTLE,
Town Clerk.

Town Hall, Middleton,
March 2, 1906.

ALTRINCHAM GAS COMPANY.

COAL AND CANNEL CONTRACTS.

TENDERS are invited for best screened GAS COAL and CANNEL for One, Two or Three Years commencing the 1st of July, 1906.

Estimated quantities required per Year: Coal, 12,000 Tons; Cannel, 4000 Tons.

Deliveries to be free at Altrincham Railway Station and as required.

Sealed Tenders, endorsed "Tender for Coal" or "Cannel," stating the description of each, the Pits from which they are to be raised, the amount proposed to be supplied, and cash terms for monthly payments to be sent addressed to the undersigned, so as to be received not later than Twelve o'clock noon on the 12th inst.

The Directors do not bind themselves to accept the lowest or any Tender; but the person or persons whose Tender may be accepted will be required to execute an Agreement for the due performance thereof.

No Special Form of Tender is required or supplied.

F. R. B. LINDSELL,
Secretary.

Gas Offices, Altrincham,
March 1, 1906.

COUNTY BOROUGH OF HUDDERSFIELD.

SUNDRY STORES.

THE Gas Committee of the Corporation of Huddersfield invite TENDERS for the following STORES and MATERIALS required during the Twelve Months ending March 31, 1907—viz.:

1—Sundry Stores.
2—Cast-Iron Pipes and Connections.
3—Wrought-Iron Tubes and Fittings.
4—Oxide Paint.
5—Coal Stoppers.
6—Wood Purifier Grids.
7—Bags.
8—Fire-Clay Goods.
9—Lime suitable for Purification.
10—Building Lime.
11—Vitriol and Spent Oxide.

Forms of Tender and Specifications may be obtained on application to the Gas Engineer, Mr. Edward A. Harman, M.Inst.C.E., Gas-Works, Huddersfield.

Sealed Tenders, endorsed "Tender for Stores," must be delivered, free of charge, in the handwriting of the Tenderer or his Agent, to the Town Clerk, Town Hall, Huddersfield, not later than the 13th day of March, 1906, but all samples must be delivered at the Gas-Works.

The Corporation do not bind themselves to accept the lowest or any Tender.

J. HENRY FIELD,
Town Clerk.

Town Hall, Huddersfield,
March 1, 1906.

At Dalmarnock Chemical Works, 89, Rumford Street, Bridgeton, Glasgow, on Thursday and Friday, the 22nd and 23rd of March, at Twelve noon each day,

IMPORTANT PUBLIC SALE

OF

CHEMICAL Manufacturers' Plant, for TAR DISTILLING, SULPHATE OF AMMONIA MAKING, NAPHTHA REFINING, &c., including STEAM BOILERS, ENGINES, PUMPS, AIR COMPRESSORS, AGITATORS, STILLS, TANKS, CONDENSERS, DYNAMO, and MACHINE TOOLS, &c.

ROBERT M'TEAR & CO., AUCTIONEERS.

Full Particulars in Catalogues, which may be obtained post free from the AUCTIONEERS.

On View Wednesday, the 21st of March, from 10 a.m. till 5 p.m. Special Orders to View prior to Sale can also be had on application.

Royal Exchange Sale-Rooms,
Glasgow, Feb. 28, 1906.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

Price 10s. 6d., Green Cloth, Gilt Lettered.

VOL. XCII.

OF THE

JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

GREEN CLOTH CASES for Binding the Quarterly Volumes of the "JOURNAL," Gilt Lettered, Price 2s.

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

GILBERT LITTLE & CO.LTD.

Conveyor and Elevator Specialists,

Smethwick, Birmingham.

Make known your wants for Conveyors and Elevators to GILBERT LITTLE, the Pioneer Specialist; he will supply them.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and yield of Gas

Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.,
CHESTERFIELD.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER,
Gas Engineers' Agents and Contractors for
METERS, FIRE-CLAY GOODS, OXIDE OF IRON, AND ALL OTHER GAS APPARATUS.
Inquiries Solicited.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

Now Ready. Price 5s. 6d. Post Free.

REPORTS OF DISTRICT GAS ASSOCIATIONS FOR 1905.

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

THE
"BOYS"
CALORIMETER
for determining the calorific value of gases
IS MADE BY
JOHN J. GRIFFIN & SONS,
— LIMITED, —
Makers of Scientific Apparatus,
KINGSWAY, LONDON, W.C.

THE
"ROTARY"
STATION METER.
Efficiency Demonstrated.
APPLY—
T. G. MARSH,
MAWSON CHAMBERS, DEANSGATE,
MANCHESTER.

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE LIMITED,
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

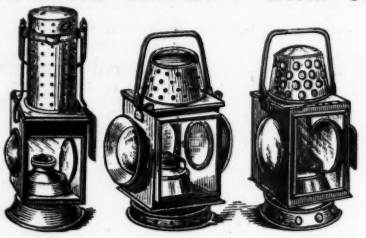
Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: H. CRESSWELL & CO., LEADENHALL CHAMBERS, 4, ST. MARY AXE, E.C.

MIRFIELD GAS COAL
UNEQUALLED.
Sperm Value 878·85 lbs. per Ton.
Please apply for Prices, Analyses, and Reports, to the
MIRFIELD (GAS COAL) COLLIERIES
RAVENSTHORPE, NEAR DEWSBURY.
LONDON: 22, Park Village East, N.W.

GAS LAMPS,
REFLECTING LANTERNS, &c.
S. SHERMAN & SON,
WEST CENTRAL GAS LANTERN WORKS
HEAD OFFICE:
57, NEW COMPTON ST., W.C.
CATALOGUE (Just Printed) ON APPLICATION.
Telephone: 4939 Gerrard.
Telegrams: "Illuminate, London."

ARMSTRONG'S PATENT
CANDLE SAFETY LAMPS.



No. 1. No. 2. No. 3.
48, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

Wrought-Iron
TUBES
And Fittings & Accessories.

LAMBERT BROS., WALSALL,
MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM.
BRASS GAS-FITTINGS, GAS VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF WARNER'S PATENT MARKET GAS STAND-PIPE.
LONDON: LAMBETH BRASS & IRON CO., LTD., 91 & 93, SOUTHWARK ST., S.E.

NOW READY, THE SECOND EDITION OF
GAS COMPANIES' BOOK-KEEPING.
A PRACTICAL TREATISE ON THE KEEPING OF GAS COMPANIES' ACCOUNTS.
By JOHN HENRY BREARLEY, of Longwood, and BENJAMIN TAYLOR, of Cleethorpes.

The only Complete Treatise on Gas Companies' Book-Keeping ever published.

This Book will be found invaluable to those desirous of obtaining a thorough grasp of Gas Companies' Book-Keeping and Accountancy.
A complete set of Transactions are dealt with; the same being entered into the various Books, and posted into the Ledgers. A Mode Balance-Sheet is prepared from the set of transactions and postings.
Forms and subsidiary books are illustrated and described. The linking together of the various books is shown at a glance by means of a Chart.

The Volume contains Two Works—(1) Gas Companies' Book-Keeping; (2) Useful Forms for Gas Undertakings.
Price Net: Complete, Cloth Bound, 12s. 6d.; Morocco Gilt, 18s.

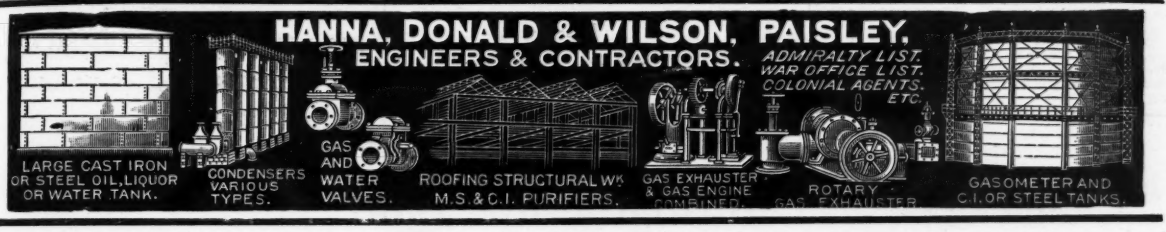
LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

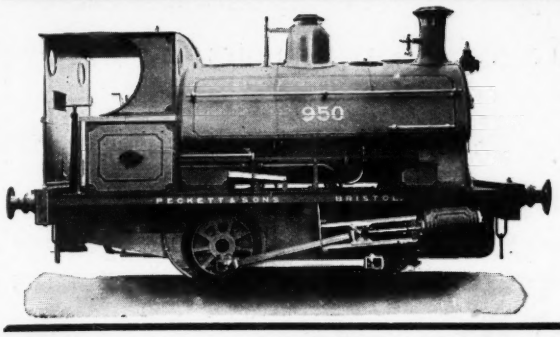
ALEXANDER CAMERON,
GAS AND CANNEL COAL MERCHANT,
48, WEST REGENT STREET,
GLASGOW.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.
Manufacture and keep in Stock at their Works
(also large Stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

THOMAS TURTON
AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
LONDON OFFICE:
90, CANNON STREET, E.C.

HANNA, DONALD & WILSON, PAISLEY.
ENGINEERS & CONTRACTORS.
ADMIRALTY LIST.
WAR OFFICE LIST.
COLONIAL AGENTS.
ETC.

LARGE CAST IRON OR STEEL OIL, LIQUOR OR WATER TANK.
CONDENSERS VARIOUS TYPES.
GAS AND WATER VALVES.
ROOFING STRUCTURAL WK M.S. & C.I. PURIFIERS.
GAS EXHAUSTER & GAS ENGINE COMBINED.
ROTARY GAS EXHAUSTER
GASOMETER AND C.I. OR STEEL TANKS.



LOCOMOTIVES
LOCOMOTIVES of all Sizes and Gauges specially constructed for Main and Branch Lines, Contractors, Docks, Gas-Works, Collieries, Iron-Works, Brick and Cement Works, &c. Locomotives of various Sizes always in Stock, ready for immediate delivery.
Photographs, Specifications, and Prices on Application.
PECKETT & SONS, Atlas Locomotive Works, BRISTOL.
Telegraphic Address: "PECKETT, BRISTOL."

SAML. CUTLER & SONS,
MILLWALL, LONDON.
GASHOLDERS.
STEEL TANKS.
CONDENSERS.
ROOFS.
JÄGER GRIDS
CAPACITY OF PURIFIERS DOUBLED.
PRESSURE CONSIDERABLY REDUCED.
Special Circular describing the Jäger System of Purification on application.
CARBURETTED WATER GAS
Maximum Efficiency Guaranteed.
A LARGE NUMBER OF PLANTS IN OPERATION.
Every Requirement for Gas-Works.
(195)

Get the

LUCAS LIGHT

"The Sunny Light"

Catalogue for 1906

if you hav'nt had it yet. It gives all particulars about the simplest of high-power Lamps, also about "Sydney" Lamps and "K" Burners.

MOFFAT'S LTD., 155, FARRINGDON ROAD, LONDON, E.C.

THE HORSELEY CO., LTD., TIPTON, STAFFORDSHIRE.

MAKERS OF **GASHOLDERS & GAS PLANT.**

PURIFIERS, SCRUBBERS, CONDENSERS, WASHERS, TANKS, VALVES, PIPES, LAMP-PILLARS, RETORT-FITTINGS, ETC.

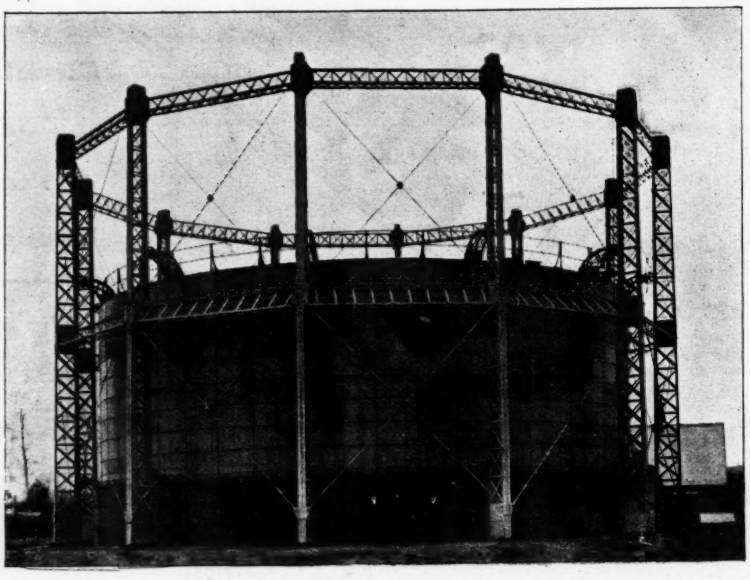
ALSO ALL KINDS OF

STRUCTURAL IRON AND STEEL WORK

BRIDGES,

ROOFS,

PIERS, ETC.



WORKS & HEAD OFFICE:
TIPTON,
STAFFORDSHIRE

LONDON OFFICE:
11, VICTORIA STREET,
WESTMINSTER.

TELEGRAPHIC ADDRESSES:
"HORSELEY, TIPTON."
"GALILEO, LONDON."

THE "GLOBE" LIGHT, LIMITED,

138, GRAY'S INN ROAD, LONDON, W.C.

In the COURT OF APPEAL, Feb. 12, 1906.

Before the MASTER OF THE ROLLS, LORD JUSTICE ROMER, and LORD JUSTICE COZENS-HARDY.

THE NEW INVERTED INCANDESCENT GAS LAMP CO., LTD.,

VERSUS

"GLOBE" LIGHT, LIMITED.

The Appeal of the New Inverted Incandescent Gas Lamp Company, Ltd., against the Judgment of Mr. Justice Joyce in the Action for Alleged Infringement, has been decided in favour of the

"GLOBE" LIGHT, LIMITED,

AND THE

APPEAL OF THE PLAINTIFFS WAS DISMISSED WITH COSTS.

The "GLOBE" LIGHT, LIMITED, take this opportunity of thanking their numerous customers for the congratulations that have literally poured in upon them on the result of this Action. They are about to place an improved Burner upon the market, but claim that the original "GLOBE" Light **IS STILL THE BEST BEFORE THE PUBLIC.**

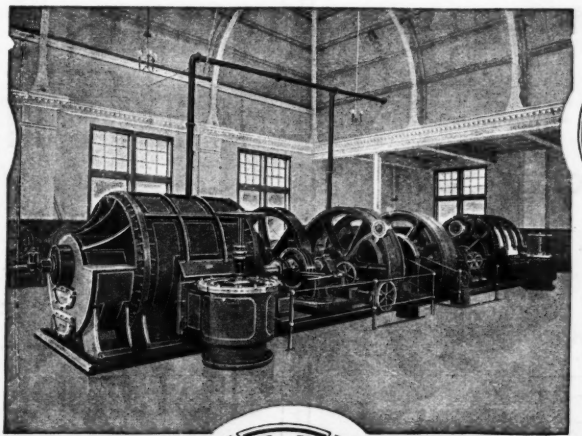
Full Particulars as to Price (which, for quantities, has been much reduced) will be sent upon application.

THE "GLOBE" LIGHT, LTD., 138, GRAY'S INN RD., LONDON, W.C.

R. LAIDLAW & SON,

LIMITED

GAS & WATER ENGINEERS,



SIMON SQUARE WORKS, EDINBURGH.

6 LITTLE BUSH LANE, LONDON, E.C.

TWO EXHAUSTERS EACH TO PASS 750000 CUB. FT. PER HOUR AT 60 REVOLUTIONS PER MINUTE DRIVEN BY TWO GAS ENGINES

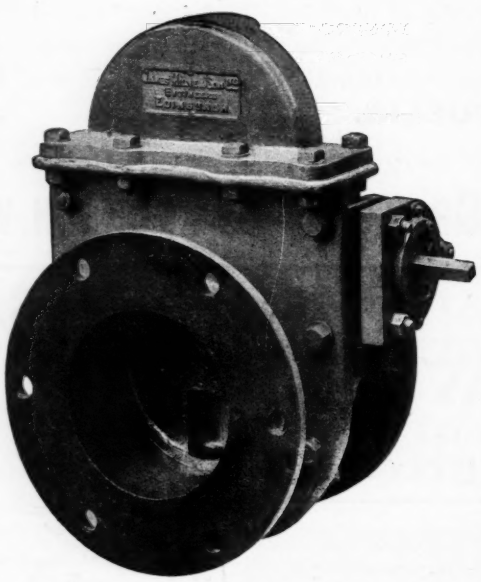
AND INTERMEDIATE FRICTIONAL GEARING, ERECTED AT GRANTON GAS WORKS FOR EDINBURGH & LEITH GAS COMMISSIONERS

ALLIANCE FOUNDRY & ENGINEERING WORKS, GLASGOW.

RACK & PINION GAS VALVES

USUAL SIZES IN STOCK.

FACES MACHINED THROUGHOUT.



Valves and Seats Hand-Scraped.

TESTED AT

15 lbs. per square inch.

MADE BY

JAMES MILNE & SON

LIMITED,

Milton House Works, EDINBURGH, . . .

Also at LONDON, GLASGOW, and LEEDS.

Jubilee of the Coal Tar Colour Industry.

ROMANCE OF SCIENCE SERIES: COAL AND WHAT WE GET FROM IT. By Professor R. Meldola, F.R.S., F.I.C., &c. Third Edition, with numerous diagrams. Post 8vo., cloth boards, 2s. 6d.

"An intelligible account of the successful stages in the development of the coal-tar industry without assuming any knowledge of chemical science on the part of the reader is undeniably bold."—*Chemical News.*

This is a work of general importance, and on the occasion of the Jubilee of the Coal Tar Colour Industry of special interest.

The work forms one of the Romance of Science series, of which the latest additions are—

THE NEW STATE OF MATTER. An Address by Professor H. Pellat, of the Sorbonne, delivered April 3rd, 1905. Translated by Edmund McClure, M.A. Small post 8vo., cloth boards, 1s.

SOUNDING THE OCEAN OF AIR: being Six Lectures delivered before the Lowell Institute of Boston in December, 1898, by A. Lawrence Rotch, S.B.A.M. With numerous Illustrations. Small post 8vo., cloth boards, 2s. 6d.

THE MACHINERY OF THE UNIVERSE. MECHANICAL CONCEPTIONS OF PHYSICAL PHENOMENA. By A. E. Dolbear, Ph.D., Professor of Physics, Tuft's College, U.S.A. Small post 8vo., with several Diagrams. Cloth boards, 2s.

SOCIETY FOR PROMOTING CHRISTIAN KNOWLEDGE,

LONDON: NORTHUMBERLAND AVENUE, W.C.; 43, QUEEN VICTORIA STREET, E.C.
BRIGHTON: 129, NORTH STREET.

MODERN METHODS OF SAVING LABOUR IN GAS-WORKS

(With Sixty Illustrations),

By C. E. BRACKENBURY, Assoc.M.Inst.C.E.

Being a Reprint of Six Articles contributed to the "ENGINEERING TIMES."

I. Historical and General Introduction.
II. Inclined Retorts.
III. Stoking Machinery for Horizontal Retorts.
IV. Coke Plant.
V. Carburetted Water-Gas Plant.
VI. Purifying Plant.

PRICE 3s. 6d. NET.

LONDON: WALTER KING, 11, BOLT COURT, FLEET ST., E.C.

"NUGEPE" GAS PLANT CEMENT

For AMMONIA JOINTS.
For TAR JOINTS.

Makers: JOHN E. WILLIAMS & CO., *Lower Moss Lane,* MANCHESTER, S.W.

BOWENS' Ltd. Successors, STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.

ESTABLISHED 1860.

GAS COAL AND CANNEL.

WILSON CARTER & PEARSON, LIMITED.

Gas, Steam, and other Fuel for Home and Export.

GAS COKE CONTRACTORS.

CHIEF OFFICES:

50, NEW STREET, BIRMINGHAM.

THE THAMES BANK IRON CO.

UPPER GROUND STREET, LONDON, S.E.

SUPPLY FROM STOCK

CAST-IRON RETORTS AND ALL KINDS OF GAS-WORKS APPARATUS.

SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.

Sole Manufacturers of LYON'S "PATENT" GAS-MAIN SYPHONS.

AGENTS FOR

ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

GEORGE WILSON, COVENTRY,

Wet and Dry Gas Meter Manufacturer.

PREPAYMENT METERS for Pennies, Shillings, or any other Coin.

THE EVESON COAL & COKE CO.

BIRMINGHAM. LTD.

W. G. BEAUMONT & SONS,

Painters to H.M. Government,

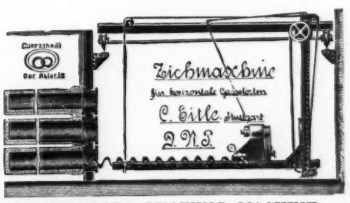
PRIORY ST., BROMLEY-BY-BOW, LONDON, E.

Contractors for PAINTING Gasholders, Bridges, Markets, Public Buildings, &c.

C. EITLE, ENGINEERING WORKS, STUTTGART.

Telegraphic Address: "EITLE, STUTTGART." Telephone: No. 635.

"KOBOLD" CHARGING APPARATUS.



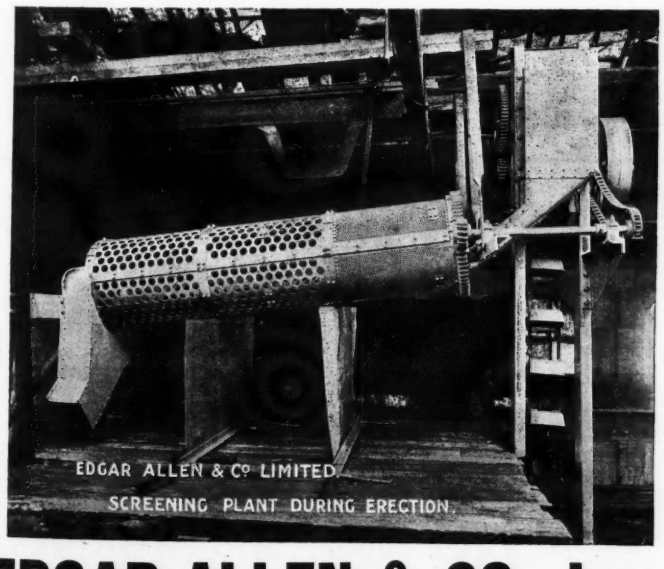
"SCHLANGE" DRAWING MACHINE

ADVANTAGES OF THE "KOBOLD" CHARGING APPARATUS.

1.—The simplest of all existing Charging Machines, as in charging there is only ONE shaft working.
2.—Almost indestructible in construction, as there are no combustible parts exposed to the heat of the Retorts.
3.—Uniform bed of coal of any desired height in the retort, and consequently any desired weight of charge may be inserted.
4.—Greater yield of gas in comparison with all other types, owing to the coal being deposited in the retort most advantageously.
5.—Least inrush of cold air owing to the close fit of the charging mouthpiece with the retort mouthpiece, with consequently practically no cooling of the retort, the least outrush of flame and smoke, and therefore smallest loss of gas.
6.—Smallest consumption of power.
7.—Most rapid working, as the complete charging of a retort requires only two pulls of a lever.
8.—May be set at any position in regard to height by either manual or motor power.
9.—Lowest cost to purchase; paying interest and redemption in about three years.

ADVANTAGES OF THE "SCHLANGE" DRAWING MACHINE.

1.—The simplest and best drawing machine in the world for horizontal retorts.
2.—Least time required to draw a retort (10-15 seconds).
3.—Most careful treatment of the lumps of coke, as well as the retort.
4.—Smallest consumption of power.
5.—Lowest cost to purchase.
6.—Most substantial construction, and consequently very low maintenance charges.
7.—Rapid and cheap working, consequently pays interest and redemption in a few years.



PULVERIZING,
GRINDING,
SEPARATING,
STORING,
WASHING, and DRYING MACHINERY.

For all Classes of Material.

Coal & Coke Handling Plants.

TOOL STEEL, FILES, &c.

COAL & CANNEL BREAKERS.

EDGAR ALLEN & CO., LD., IMPERIAL STEEL WORKS, SHEFFIELD.

JOHN BROWN & CO., LTD., SHEFFIELD,

Proprietors of

ALDWARKE MAIN, CAR HOUSE, & ROTHERHAM MAIN COLLIERIES. NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 Feet of 19-Candle Gas per Ton.

Value in Pounds of Sperm, 820·20.

VERY FREE FROM IMPURITIES.

TELEGRAMS: "ATLAS, SHEFFIELD."

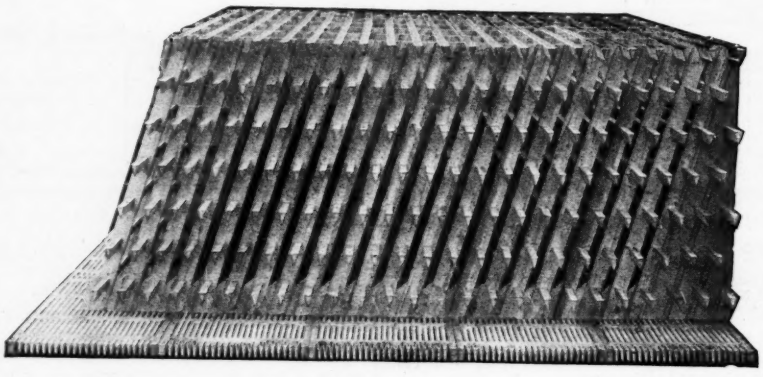
SPENCER'S PATENT HURDLE GRID

The very best Patent Grid on the Market for Holding Oxide Lightly,

And Holding Oxide Lightly is the Secret of Success for Better Purification.

No Extra Cost in adopting this system to existing Purifiers.

They are Self-Supporting, saving the cost of Standards and Bearers.



Can make the Change from the Old to the New System without any Stoppage.

Simple in Construction and very easy to fix in Position.

The ADVANTAGES with SPENCER'S PATENT HURDLE GRID have been proved during this Winter at several Places, where full Sets have been used:

1—To have passed 50 per cent. more Gas.
2—And reduce the number of changes per Purifier one-half.
3—Also reduce Back-Pressure 75 per cent.

References as to above can be had on Application.

WALTER SPENCER, GRID WORKS, ELLAND.

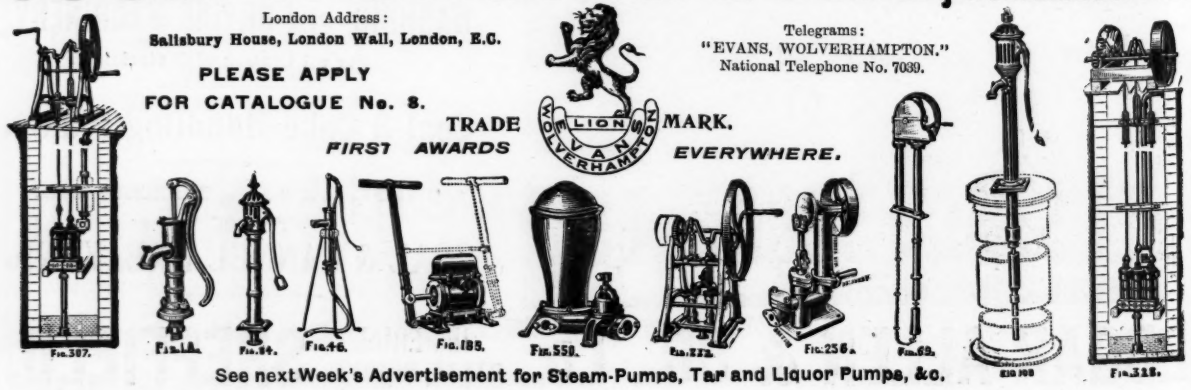
JOSEPH EVANS & SONS, CULWELL WORKS, WOLVERHAMPTON.

London Address:
Salisbury House, London Wall, London, E.C.

PLEASE APPLY FOR CATALOGUE No. 8.

Telegrams:
"EVANS, WOLVERHAMPTON."
National Telephone No. 7039.

TRADE MARK.
FIRST AWARDS EVERYWHERE.



See next Week's Advertisement for Steam-Pumps, Tar and Liquor Pumps, &c.

WELSBACH LIGHT

(PATENTED)

Fig. 35. 100 c.p.

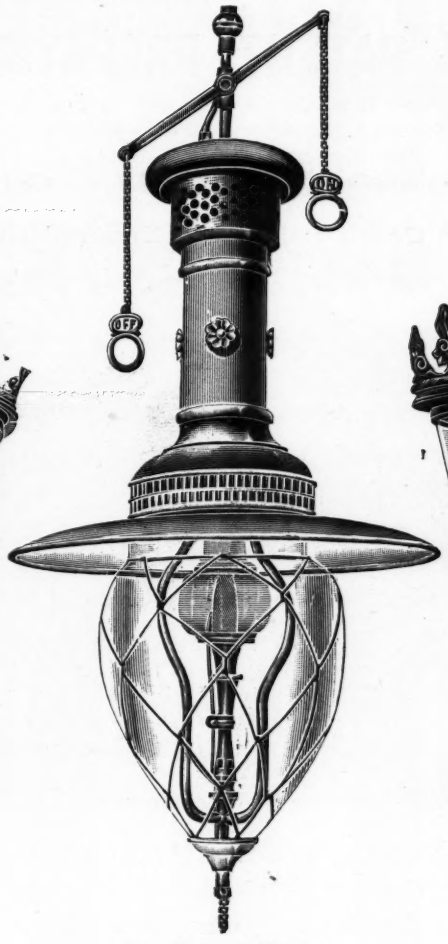


Fig. 607. 600 c.p.
Self-Intensifying.

Fig. 35a. 300 c.p.
Self-Intensifying.

WELSBACH "C," "CX," AND PLAISSETTY MANTLES,

4½d. each, subject.

Thousands of the above Lamps in use and giving satisfaction.

EACH LAMP AND MANTLE GUARANTEED.

THE

WELSBACH INCANDESCENT GASLIGHT CO.

LIMITED,

2 to 14, Palmer Street, WESTMINSTER, S.W.

Telegrams: "WELSBACH, LONDON" *Telephone: 290 WEST.*

ALDER & MACKAY,

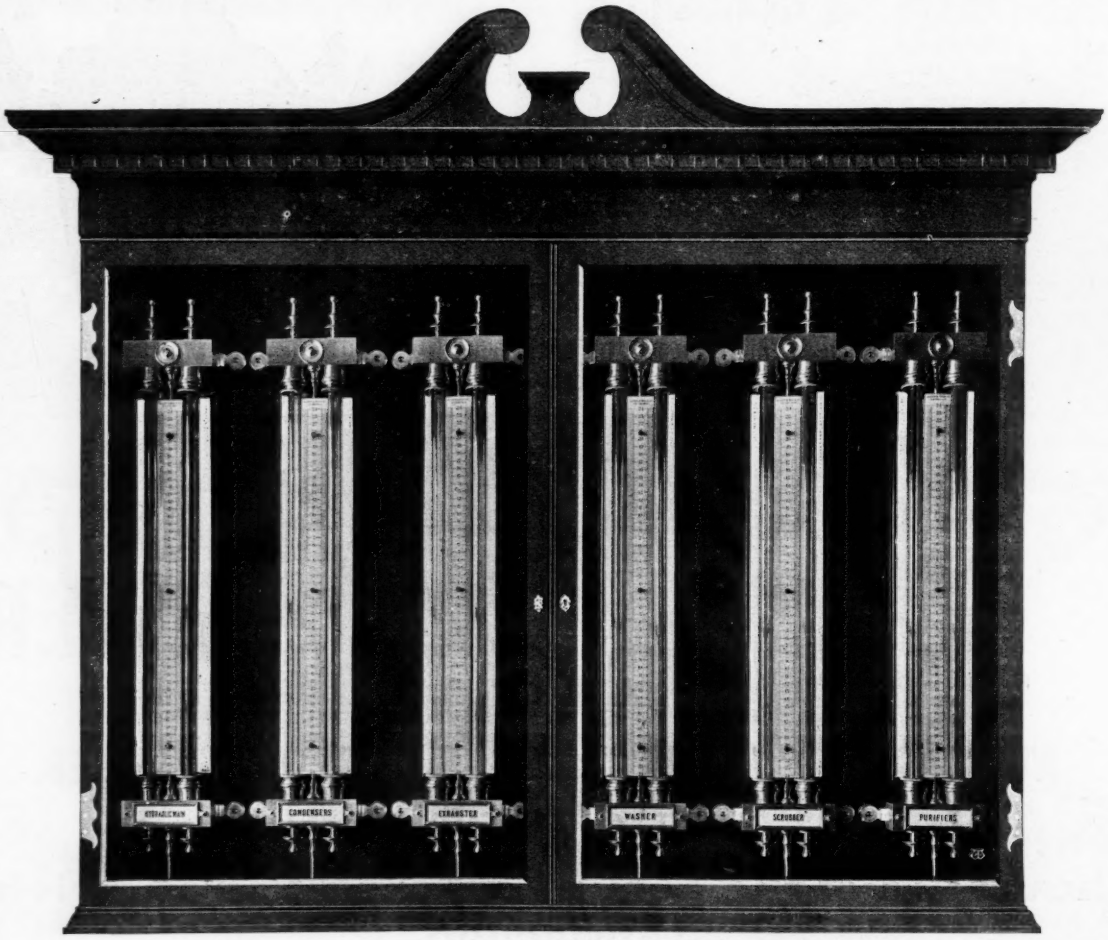
MAKERS OF

WET AND DRY PATENT PREPAYMENT METERS.

Made for any Coin. Noted for Reliability.

PRICE EASILY AND ACCURATELY CHANGED *IN SITU.*

Simple in Construction. Ensured Durability.



Cabinet of Pressure Gauges with Glazed Doors.

Pressure Gauges of the Best Make and Finish in every style to suit large or small works.

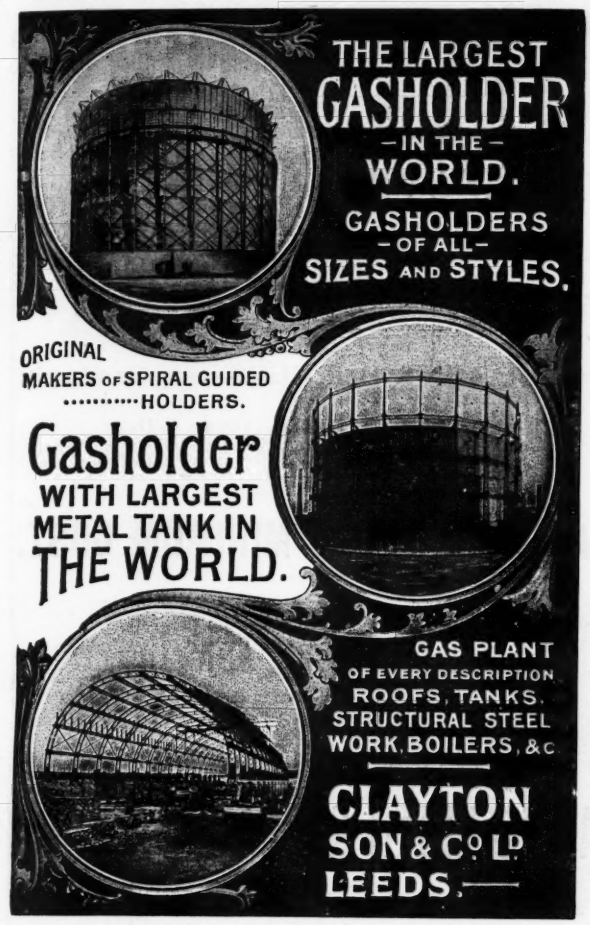
FULL PARTICULARS, DRAWINGS, AND PRICES ON APPLICATION.

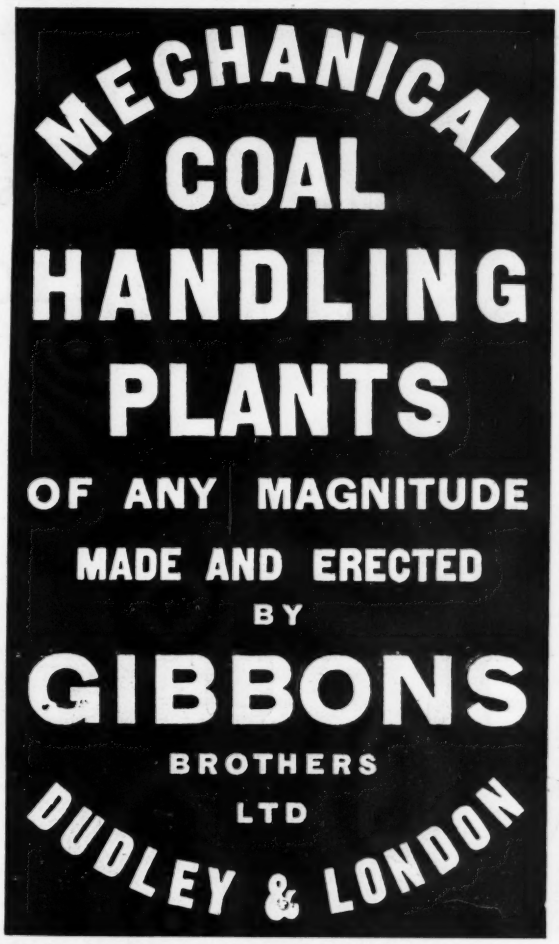
NEW GRANGE WORKS,
EDINBURGH.
Telegrams: "ALDER EDINBURGH."
Telephone: 1481 CENTRAL.

VENTNOR STREET WORKS,
BRADFORD.
Telegrams: "ALDER BRADFORD."
Telephone: 1222.

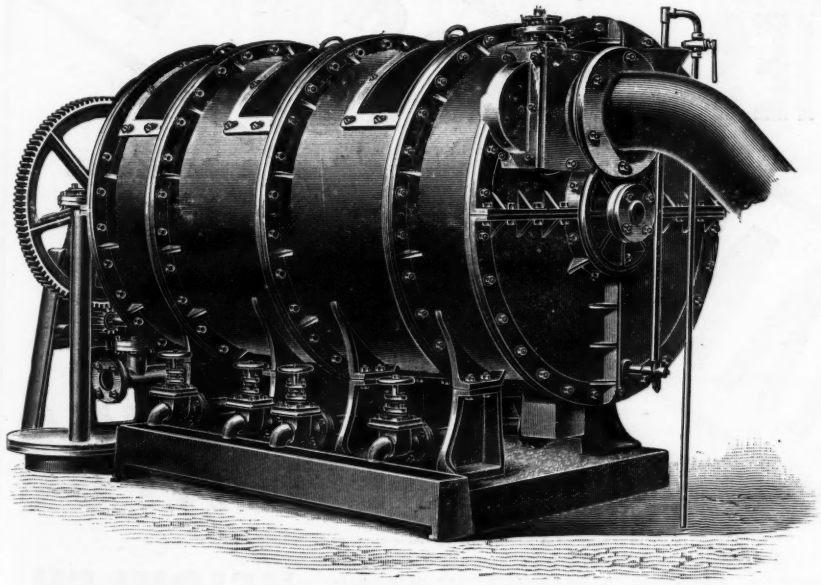
13, VICTORIA STREET,
WESTMINSTER,
LONDON, S.W.
Telegrams: "ALDERUGI LONDON."

CENTRAL HOUSE,
NEW STREET,
BIRMINGHAM.
Tele.: "ALDERUGI BIRMINGHAM."





R. & J. DEMPSTER, LTD.,
OLDHAM ROAD, MANCHESTER.



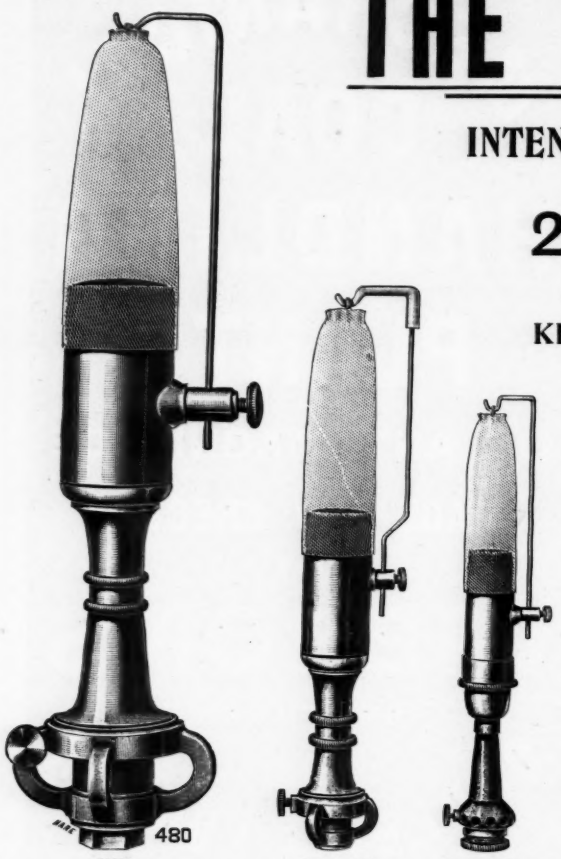
ROTARY

WASHER-
SCRUBBERS

Photo. of the 250,000 cubic feet per 24 hours size.

London Office: 165, GRESHAM HOUSE, OLD BROAD ST., E.C.

THE KEITH LIGHT.



1000 c.p. 30 to 500 c.p. 150 to 250 c.p.

INTENSIFIED INCANDESCENT GAS.

2000 INSTALLATIONS NOW IN USE.

KEITH'S PATENT BURNERS are made in various sizes up to 1000 c.p.

MAINTAINED AT A MINIMUM COST.

Perfect Air-inlet Adjustment.

Patentees and Manufacturers:

JAMES KEITH & BLACKMAN CO., LTD.,

27, FARRINGDON AVENUE, LONDON, E.C.

FOR PATENT "ECLIPSE"

SPECIALITIES

WRITE

CLAPHAM BROS., LTD.

MAKERS OF ALL KINDS OF

GAS APPARATUS

WELLINGTON, NELSON, & MARKET ST. WORKS, KEIGHLEY.

London Representatives: JONES & YOUNGER, 98, Great Tower Street, E.C.

Scotch Representative: JOHN D. GIBSON, 74, York Street, Glasgow.

Printed and Published by WALTER KING, at No, 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON—Tuesday, March 6, 1906.